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Agriculture

Volume LXV Number 12

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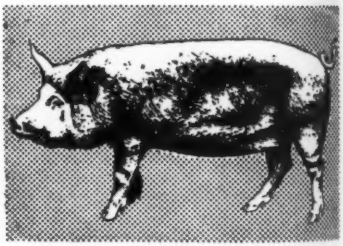

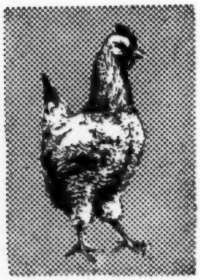

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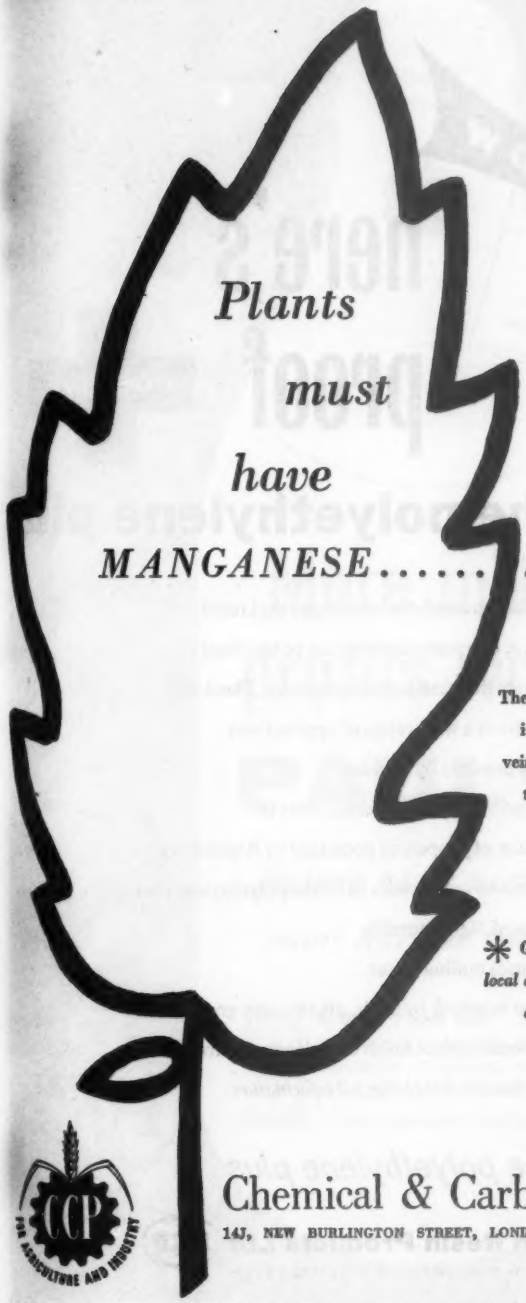

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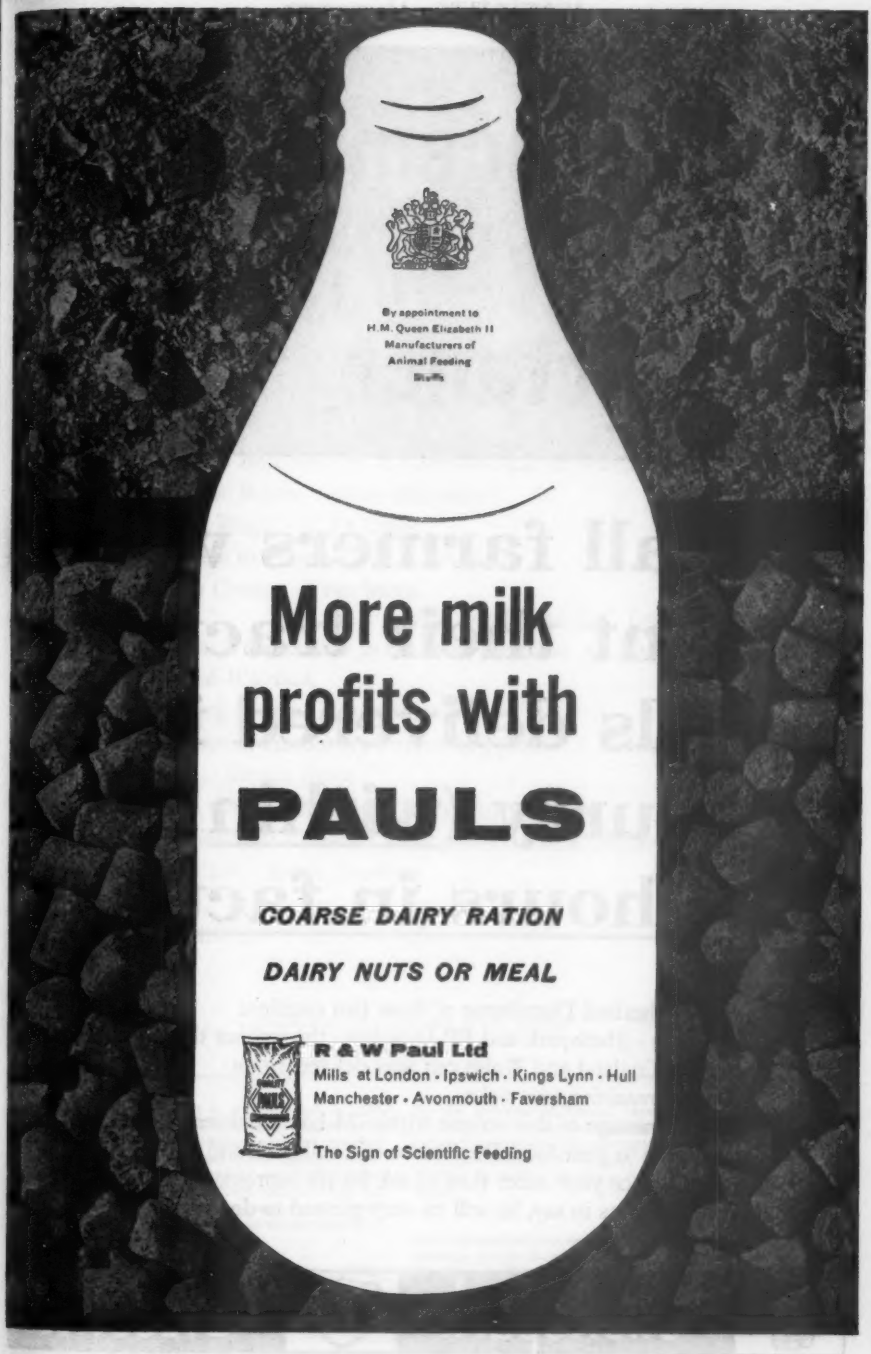
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Agriculture

Volume LXV Number 12 March 1959

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CONTENTS

Farm Size and Farm Business. *B. E. Cracknell* and *H. Palca* . . 593
New Thinking about Roots. *Henry Edmunds* 598
The Battle against Blight. *E. C. Large* 603
Mechanical Damage to Potatoes. *H. J. Hine* 608
Timing Sprays for Control of Pea Moth.
H. J. Gould and *Z. J. Legowski* 611
Eradicating Bovine Tuberculosis in the Irish Republic. *P. Crowley* . 615
Night Call. *Ralph Whitlock* 618
Simplifying Farming Systems. *John Harrison* 619
N.A.A.S. Experimental Husbandry Farms: Liscombe. *J. M. Willcock* 623
Visit to Denmark. *Dennis Hurst* 626
Air Conditions in the Broiler-house. *C. G. Payne* 629
Farming Cameo Series 2: 12. South Denbighshire. *D. J. Thomas* . 635
At the Farmers' Club. *Sylvia Laverton* 637
In Brief 639
Ministry's Publications 642
Book Reviews 643

Cover photograph: Cornish harvest: daffodils being picked at Boskenna *Photo: The Times*

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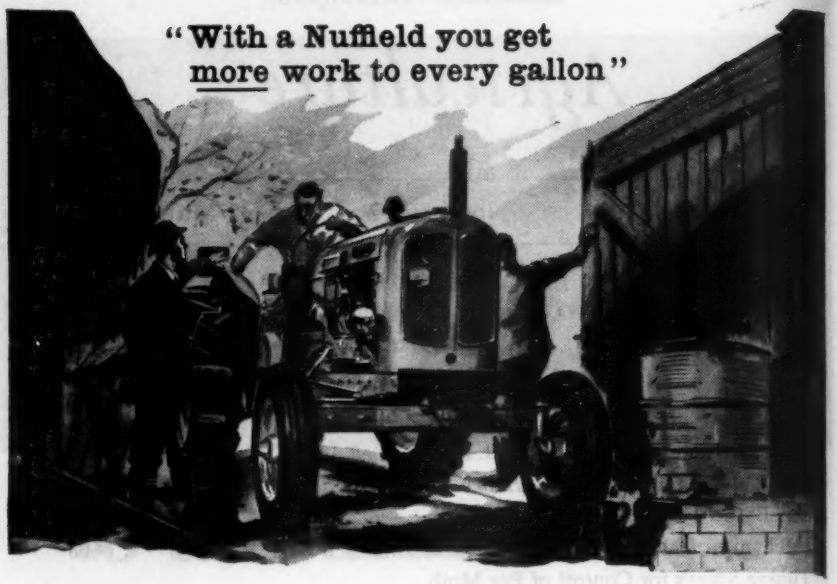

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Farm Size and Farm Business

A New Classification of Agricultural Holdings by Standard Labour Requirements

B. E. CRACKNELL, B.SC.(ECON.)PH.D., and H. PALCA, M.SC.(ECON.)
Ministry of Agriculture, Fisheries and Food

AT first sight it may seem curious that although agricultural statistics have been collected in England and Wales for over ninety years, it has been impossible to give an accurate answer to the simple question: "How many farms are there in England and Wales?" But the question is not really as simple as it looks. There is no standard or statutory definition of a farm. Probably there would be general agreement that a farm must be in some sense a business, and that this business must occupy all or most of its proprietor's time. But hitherto there has been no means of discovering systematically and regularly how many businesses there are, or how much time is spent on them. In the absence of this information, it has not been possible to do much more than assume, as a very rough and ready measure, that all agricultural holdings below a certain size (say 20 acres) are not farms, and those above it are. But this is unsatisfactory, because even very small holdings can be farms if they are stocked sufficiently intensively with (say) pigs and poultry, while, at the other extreme, holdings nearer 50 than 20 acres can be found that are no more than a spare-time occupation. Hence we need some criterion other than acreage which is precise and at the same time easy to apply.

During the last war, for immediate administrative use, an attempt was made as part of the National Farm Survey of 1941–43* to classify occupiers of agricultural holdings. A dual system of classification was used. In the first place all holdings of less than 5 acres were omitted altogether. These 70,000 holdings (out of a total of some 360,000) would have included some intensive pig and poultry and horticultural holdings which might be called farms, but the vast majority were merely small plots of pasture, orchards, etc., comprising less than one per cent of the total area of crops and grass in the country. The remaining holdings were then classified according to the investigator's impression of the occupier's economic status. If farming was his main occupation and source of livelihood but he had some other occupation beside farming, he was classified as part-time (32,500). If he was primarily engaged in some ocupation other than farming and carried on his holding, for profit, in his spare time, he was classified as spare-time (28,500). The great majority of the occupiers of the remaining 229,600 holdings were classified as full-time farmers.

Such a classification, based on the economic status of the occupier in

* Summary Report of National Farm Survey of England and Wales 1941–1943 (H.M.S.O.). Pioneer work in the classification of occupiers is contained in *Farms and Estates of Buckinghamshire* (E. Thomas and C. E. Elms 1938).

1941–43, quickly became out of date. For a more enduring classification, and one less dependent upon the personal judgment of enumerators, attention after the war was directed towards a system linked more closely to the farm itself. In 1951 the Farm Economics Branch of the Scottish Department of Agriculture introduced a system of classification based on the man-hours of employment represented by the cropping and stocking on the farm. The technique of standard labour requirements, for this and other purposes, had already been in use in the United States for many years, and its use had been pioneered in this country by the Farm Economics Branch of the Cambridge School of Agriculture.

Measuring the farm business

In recent years, increasing attention has been paid to the problems of the small farmer, and it became necessary to define what a "small farm" was. Clearly, acreage alone was an insufficient criterion, and any classification based on the status of the occupier was impracticable. It was therefore decided that the "small farm" should be defined according to the size of farm business, and that this should be measured by standard labour requirements, obtained from costings investigations carried out by University Departments of Agricultural Economics.

Table 1

Distribution of holdings in England and Wales by size of holding and standard labour requirements (man-days), June 1955

Estimated number of holdings in each group

Size of holding (acres of crops and grass—excluding rough grazing)	Man-day groups (standard labour requirements)				Total number of holdings (*thousands*)
	150 or less	151–275	276–450	451 and over	
0– 19¼	126	27	11	9	173*
20– 99¼	11	15	32	68	126
100–149¼	—	—	1	30	31
150–299¼	—	—	—	33	33
300 and over	—	—	—	13	13
TOTAL	137	42	44	153	376

* Including about 6,700 holdings consisting entirely of rough grazings.

The task of measuring the labour requirements of all the 376,000 agricultural holdings in England and Wales by hand was impracticable, but it was made possible, on a sample basis, by the use of an electronic computer recently installed in the Ministry's offices at Guildford to deal with deficiency payments and other financial transactions. Punched cards were already available for a 20 per cent sample of the June 1955 census returns. The electronic computer was "programmed" so that it would multiply the code for each item of cropping and stocking on the census return by the appropriate standard labour requirements and add the resulting figures to give the total labour requirements on each holding. The standard man-days used in the analysis were those listed in the White Paper (Cmnd. 553), except for a few minor differences arising mainly from the fact that the White Paper figures related to the

United Kingdom rather than to England and Wales only. Table 1 gives a summary of the results of this analysis.

The figures in Table 1 require adjustment for two reasons. First, they relate to 1955, the year for which punched cards were available, and need to be brought up to date (1957). This is necessary because the number of agricultural holdings in England and Wales fell by 8,000 during these two years, a substantial decline which was partly the result of a tightening-up of the procedure to avoid separate agricultural returns being completed for holdings which were in effect outlying parts of farms.

The second reason why the table requires adjustment is that not every holding is a separate "farm", using the word in the sense of a "farm business". For instance, many farmers farm two or more holdings with full interchange of machinery and livestock, etc., so that the holdings are in fact being farmed to all intents and purposes as one farm business. Our information on these is very limited, but an examination early in 1958 of occupiers' names and addresses showed that there were about 31,000 holdings which were occupied in pairs, threes, etc., by only 13,000 farmers. These 31,000 may be termed "related holdings" and their 13,000 occupiers "multiple occupiers". Some of these "related holdings" (especially the larger ones) are undoubtedly run as separate farms, so that it would be unrealistic to assume that the true number of holdings is 350,000 (that is, 368,000 less all the difference between 31,000 and 13,000). However, most of the smaller "related holdings" are probably parts of farm businesses which include other holdings, and it is estimated that the actual number of holdings, after allowing for these, is about 356,000. Corresponding adjustments have been made to the numbers in each size-of-holding and man-day sub-groups in the table.

The results after making these two adjustments, which obviously involve some guesswork, are summarized in Table 2.

Table 2

Distribution of holdings in England and Wales by size of holding and standard labour requirements (man-days), June 1957

Estimated number of holdings (after adjusting for related holdings) in each group

Size of holding (acres of crops and grass—excluding rough grazing)	Man-day groups (standard labour requirements)				Total number of holdings (*thousands*)
	150 or less	151–275	276–450	451 and over	
0– 19¾	116	22¼	12½	9	160*
20– 99¾	5	11¼	31¼	68	116
100–149¾	—	—	1	32	33
150–299¾	—	—	—	34	34
300 and over	—	—	—	13	13
Total No. of holdings	121	34	45	156	356
Average size (acres of crops and grass)	6½	17	36	137	69
Per cent total crops and grass in group	3	2½	6½	88	100

* Includes about 5,600 holdings consisting entirely of rough grazings.

This table can be used to help answer the question posed in the first paragraph. In 1957 the number of holdings requiring 276 or more standard man-days was 201,000 in England and Wales. We may take this figure as a first approximation to the number of farms in that year, where farms are defined as holdings with sufficient cropping and stocking to provide employment for at least one man for a full year (given average labour efficiency). The table also shows that there were 34,000 holdings requiring 151 to 275 standard man-days. Most of these will be part-time holdings which would not satisfy the above definition of a farm.

The bottom three lines reveal that one-third of all holdings (those with 150 or fewer man-days standard labour requirements) with an average size of about 6½ acres of crops and grass, cover only three per cent of the total crops and grass area in England and Wales. None of these holdings would do more than provide some food for the family and a small amount for sale as a supplement to the occupier's main source of income. At the other end of the scale, holdings with 451 or more man-days standard labour requirements (44 per cent of all holdings) cover 88 per cent of the area.

Table 3 shows the distribution of holdings in greater detail.

Table 3

Estimated numbers of holdings in England and Wales, by size of holding and man-day groups, June 1957*

(thousand holdings)

Man-day groups	Size of holding (acres of crops and grass)								
	Nil (but over 1 acre of rough grazing)	¼–4¼†	5–19¼	20–49¼	50–99¼	100–149¼	150–299¼	300 and over	Total
Up to 50	4·1	40·0	15·0	0·5	—	—	—	—	59·6
51–100	0·5	15·8	17·0	1·0	—	—	—	—	34·3
101–150	0·3	11·0	12·2	3·5	—	—	—	—	27·0
151–200	0·2	1·9	8·8	3·5	—	—	—	—	14·4
201–250	0·1	1·3	7·3	5·0	—	—	—	—	13·7
251–275	0·1	0·4	2·2	3·0	—	—	—	—	5·7
276–300	0·1	0·5	1·8	3·1	0·7	0·1	—	—	6·3
	0·2	0·9	4·0	6·1					12·0
301–350	0·1	0·3	4·0	6·5	2·0	0·2	—	—	13·1
351–400	0·1	1·1	2·7	6·5	2·8	0·4	—	—	13·6
401–450	—	0·1	1·6	6·3	3·7	0·6	0·1	—	12·4
451–500	—	0·2	1·2	5·2	5·0	0·7	0·1	—	12·4
501–600	—	0·2	1·2	6·1	9·6	1·9	0·4	—	19·4
601–700	—	0·1	0·9	3·3	8·4	2·3	0·5	—	15·5
701–800	—	0·8	1·1	1·8	6·6	3·6	0·8	—	14·7
801–900	—	0·4	0·8	1·3	5·4	4·2	1·4	—	13·5
901–1,000	—	0·1	0·4	0·9	3·3	4·0	1·7	0·1	10·5
1,001 and over	—	0·5	1·3	2·8	8·6	15·0	28·6	13·2	70·0
TOTAL HOLDINGS	5·6	74·7	79·5	60·3	56·1	33·0	33·6	13·3	356·1

SOURCE: 20 per cent sample of June 1955 returns, adjusted to June 1957 and for related holdings.

* After adjusting for related holdings.

† This group relates to holdings of more than 1 acre of total agricultural acreage, i.e., including rough grazing.

Accuracy of the classification

It is important to remember that these figures relate to standard labour requirements and not to the actual labour employed on the farm. For instance, an elderly farmer on poor land may have full-time employment, although the standard man-days of his farm may amount to only, say, 200. On the other hand, an efficient, hard-working young farmer with a little help from his wife, might manage, on a part-time basis, a holding with over 275 man-days. To check whether a classification based on standard man-days corresponds reasonably well with what is found in practice, the Ministry, with the help of the Provincial Agricultural Economists at Nottingham, Reading, Bristol and Aberystwyth (whose assistance is gratefully acknowledged) carried out a field-check on some 270 farms chosen at random from seven counties of England and Wales, on each of which the cropping and stocking had been estimated to provide not more than 200 man-days. The results may be summarized as follows:

	Holdings	*per cent*
1. Holdings on which the occupier claimed to be farming full-time	24	9
2. Holdings in fact farmed in conjunction with other holdings	24	9
3. Holdings farmed on a spare-time basis:		
(a) Occupier not employed full-time but no other occupation shown (that is, occupier generally a retired or disabled person)	77	29
(b) Occupier had another occupation connected with agriculture	38	14
(c) Occupier had another occupation not connected with agriculture	106	39
TOTAL	269	100

Excluding the holdings farmed in conjunction with other holdings, this analysis shows that on only 10 per cent of the farms classified as spare-time or part-time did the occupier claim to be occupied full-time. It was not possible, in these cases, to check that the farm did in fact provide full-time employment. The survey was on too small a scale for any detailed conclusions to be drawn, but at least it suggests that a classification by standard man-days does give results which are consistent with the facts, for on 90 per cent of these holdings requiring 200 or fewer standard man-days the occupier was found to be either a retired or disabled person or to have some other occupation.

The work involved in the planning and presenting of the results quoted here was undertaken jointly by colleagues in several sections of the Ministry. Among these, the authors would like particularly to mention Dr. Keith Dexter (Agricultural Economics Unit) and Mr. A. Fillmore and his staff (Payments Unit).

New Thinking about Roots

HENRY EDMUNDS, B.SC.

County Agricultural Officer, Breconshire

The writer looks at the place of roots in stock-feeding and suggests that, with modern techniques and tools, the possibilities of swedes, in particular, should be more fully explored.

ALTHOUGH this article is mainly concerned with the orphans of British crops —swedes and mangolds—it would be incomplete if it ignored the other bulky farm crops which are also generally available for winter feeding. These include hay, silage and the kales.

The conventional technique when considering such a range of crops is to compare them on a unit cost of starch and protein equivalent. Whether this approach really means much is open to considerable doubt, but for what it is worth, the most recent and impartial comparison is that found in the Report of the Committee on Grassland Utilisation (chairman, Sir Sydney Caine).*

Estimated average costs of production of starch equivalent for various crops in 1956–57

	Cost per ton of S.E. £
Grazing	12·6
Meadow hay in stack	21·8
Grass silage—in clamp or pit	23·0
Dried grass	39·8
Kale—grazed	17·6
Turnips and swedes	34·6
Mangolds	36·6
Arable silage	32·0
Barley	19·6
Oats	25·8
Dairy cake (65 per cent S.E. @ £30 a ton purchased price)	46·2

The report points out that these calculations refer only to the cost of production up to the stage "where they are available on the farm". The additional expenditure involved in feeding them to livestock is not considered because it varies widely from farm to farm, but from the limited evidence available, such extra costs would not alter the above comparisons significantly.

While economic evidence may be scanty, practical experience suggests that there are considerable differences between the handling of, say, a ton of silage or roots and a ton of hay. This aspect of handling costs needs much more investigation if a comparison is to be drawn with bought concentrates, where they may be very low indeed.

* The Report, issued as a White Paper (Cmnd. 547) can be obtained from H.M. Stationery Office or through any bookseller, price 6*s.* (6*s.* 5*d.* by post).

In view of the many years of campaigning on behalf of silage, it is rather surprising that it is still dearer to use than hay, even when feeding charges are excluded. If they are included, then the comparison becomes even less favourable. On this evidence, it seems as though the case for silage must rest on other advantages. The most important of these is likely to be the self-feeding technique, for there can be little doubt that where circumstances permit it has outstanding merit.

The strip grazing of kale is another example where the niceties of rationing, which cost precious man-hours, give way to a less costly but rather more wasteful technique.[1] The same line of development applies to swedes, eaten where they are grown.[2] Ease of utilization, coupled with economy of labour, therefore appears to influence very strongly what crops should be grown.

But so far, no cheap method has been discovered for feeding mangolds. Therefore, despite their large yield of food nutrients per acre, it is difficult to see how they can ever regain their traditional place in British agriculture. If new frost-resistant varieties could be bred, it might be another story. As things are their future role seems to lie in special situations, such as a late and grassless spring, when their long-keeping quality has an unusual virtue. A small acreage for recently lambed ewes is well worth while. Where there happens to be a local trade for the sale of mangolds, their value as a cash crop at about £4 per ton should not be overlooked.

Prospect for swedes

The prospect for swedes, apart from their value for human consumption, is much more promising. We have an expanding ewe population, and for the last six to eight weeks of pregnancy some form of supplementary feeding is essential. A crop of swedes for folding is one way of meeting such a situation. In terms of cost per ton of S.E., the figure quoted by the Caine Committee is £34·6. This presumably includes lifting, topping, haulage and storage charges; if these are excluded, as they could be with a grazed crop, then a substantial reduction in costs can be made. The most recent survey from Scotland[3] shows an average net cost of production of £44 per acre, of which £8 was the cost of lifting, topping, haulage and storage. The cost therefore of the unharvested crop was £36 per acre. Since the average yield was said to be 21 tons, the cost of S.E. of a grazed crop would be £24 per ton.

But costs, whether high or low, are a reflection of technical efficiency. The many aspects of mangold and swede growing were well studied in Wales in the years between the two world wars. Thus Fagan and Watkin[4] reported that the dry matter content of mangolds was 8·5 per cent, although the national figure then quoted was 12 per cent. They stressed the importance not only of the dry matter but also of its composition. They found that early sowing (10th April) gave a lower dry matter and sugar content compared with a sowing date of 30th April. Furthermore, during storage dry matter decreased in all varieties by 1–2 per cent; so did the sugar content.

Whitehead's[5] work with swedes in North Wales was most comprehensive. He classified varieties according to their maturity as early, medium, and late. The point of maturity was taken to be the time of maximum dry matter content. After reaching this stage, the dry matter of the early and medium varieties decreased, although the fresh weight increased. This was due to the

rise in water content. The late varieties, however, showed a rising dry matter content throughout the winter. Further work by Whitehead dealt with ideal singling distances and plant populations, influence of boron on the crop, and diseases such as club root.

New tools and techniques

After the second world war a new chapter began in root husbandry. The spectacular development of insecticides like DDT and BHC largely eliminated the hitherto troublesome turnip flea beetle in the cruciferous crops. The simple and cheap act of seed dressing removed a difficulty which had beset swede growers for about two centuries. These chemicals were also effective in spray form in dealing with mangold leaf fly. Boron deficiency is nowadays easily remedied by the inclusion of borax in the soil. Club root in swedes, however, remains a problem.

New equipment has also made a big impact, even though it came from work primarily intended to benefit the sugar beet growers. Whilst efficient machines for cultivation and inter-row work had been widely used for years, the kernel of resistance was the singling operation. This was the time-consuming job, which moreover coincided with other urgent farm work, notably haymaking. As long as skilled labour was available, then there was no incentive to improve the traditional type of drill, which sowed seed thickly. Thick sowing gave a mass of overcrowded seedlings, the bulk of which had to be laboriously removed by hand tools. The first stage in improvement was the development of gappers and down-the-row mechanical thinners. But the really big advance came with the so-called precision or spacing drill. To be able to place single seeds at any desired interval was an engineering triumph; it broke the back of singling operations. There are several types now on the market, but they all work on the one seed principle.[6]

The next stage lay with seed merchants. If single seeds were desired, then uniformity in size became essential. So we had "graded" seed of swedes, turnips and kale; with mangolds the equivalent was "rubbed and graded" stock.

So far there is little published work on the space drilling technique. Maddox,[7] however, emphasizes the importance of correctly sized seed. He found that between ½ and ¾ lb of turnip seed, the exact amount depending on size and spacing, was all that was required; spacings of 2, 3 and 4 inches all proved satisfactory. Furthermore with clean fields, unsingled crops after 6 and 8 inches spacing gave yields ranging from 24 up to 37 tons per acre. In Breconshire, N.A.A.S. trials have supported the Scottish work. Thus in one experiment normal sowing and singling yielded 23 tons 18 cwt per acre; precision drilling at 1 inch and singling yielded 22 tons 19 cwt, and precision drilling at 6 inches and no singling yielded 24 tons 14 cwt. Amongst farmers in Breconshire, however the tendency is to take risks that are too big. Experience here suggests that a sensible sowing spacing is 4–5 inches; plants then appear 6–7 inches apart. For our swede crop, which is nearly all grazed off by in-lamb ewes, this often means that no hand work is necessary.

Another new weapon, of considerable potential value, is the pre-emergence spray. So far, the experimental evidence about the various chemicals and how they should be used on different root crops is almost non-existent. We

have yet to develop the best technique, for timing the date of spraying in relation to the date of sowing of the particular crop is a tricky business.

Manuring

The manurial requirements of swedes and mangolds are quite different. Broadly speaking, the vital plant foods for the two crops are phosphate and potash respectively, and this has been known for many years. The effect of fertilizer placement in swedes and turnips has been studied in Scotland by Reith.[8] He found that placing superphosphate directly below the seed at a depth of 3–3½ inches gave consistently higher yields than placing it in other positions or broadcasting. Sulphate of ammonia placed in the same position may, however, be harmful to early growth. With NPK fertilizer mixture, there did not appear to be any benefit. In the acid soils of Wales, medium soluble basic slag and mineral phosphates are generally preferred to superphosphates for swedes.

Varieties

The work on varieties which was initiated by Whitehead has now been taken over by the N.I.A.B. Since 1953, more than 130 British swedes have been tested and subsequently classified into five major groups,[9] depending upon their rate of maturity. They are Light Purple, Dark Purple, Green, Bronze and Hardy Dark Purple. The latter are confined mainly to Scotland. So far, specific varietal recommendations are made for the early maturity types only, that is the Light Purple group. They give good root yields, with rather a low dry matter content (from 8·4 to 9·8 per cent); and they are not especially winter hardy.

If the crop is to be grazed in the winter, when late ripening and frost resistance become factors of primary importance, then varieties within the Dark Purple or Green groups have to be chosen. Although the yield of root in terms of tons per acre may be lower, this is offset by a slightly higher dry matter content. Other considerations, like root shape and relative resistance to either club root or mildew, also have a bearing on ultimate choice of variety.

Yields

The published work on swedes reveals enormous differences in terms of fresh crop yields, but under modern conditions a satisfactory basis would be about 25 tons per acre. This is the figure quoted in the Caine Report. Such a crop would provide some 6,000 lb of dry matter, and contain slightly more than 4,000 lb of S.E. and 400 lb of protein equivalent. But yields substantially over this have been obtained. Thus in Scotland, crops of 40–50 tons per acre have been reported.[10]

Other factors not previously mentioned which have a bearing on yield are the germinating energy of the seed, and the size of the plant population. Bain[10] has pointed out that when energy is low, germination takes place slowly, and the young plant is vulnerable for longer than need be. Thus 40 samples of seed with a mean germinating energy of 68 per cent gave a crop

of only 11 tons per acre, while a similar number of 88 per cent germinating energy yielded 22 tons per acre.

An adequate population is considered to be in the region of 30,000 plants per acre. Such numbers are a reflection of good seed and suitable soil and tilth conditions which, with the modern space drills, permit thinner sowing. A low seed rate demands a high standard of cultivation, both before and after sowing. The old policy of safety in numbers by a heavy seed rate is now outdated; greater care is therefore needed when fewer plants are initially available.

There is a good deal of evidence to justify the belief that we have entered a new phase of root growing. The development of mechanical thinners and space drills, of sprays and dust against insects and weeds, and of approved and tested varieties of seed is a substantial achievement; "the old order changeth, yielding place to new".

References

1. Economic Use of the Kale Crop. N. BOUNDS. *Agriculture*, 1957, **64**, 386–9.
2. Sheep Fattening on Swedes. T. E. HUNT. *Agriculture*, 1958, **64**, 561–3.
3. Enterprise Cost Series 1956: Crop Costs. M. A. HAUGHS and A. D. IMPER, *North of Scotland College of Agric. Econ. Rep. No. 65*, 1958.
4. The Chemical Composition of Mangolds Grown in Mid Wales. T. W. FAGAN and J. E. WATKIN. *Welsh J. Agric.*, 1928, **4**, 102–13.
5. A Summary of Seven Years' Work on Varieties of Swede. T. WHITEHEAD. *Welsh J. Agric.*, 1940, **16**, 99–110.
6. Mechanisation and the Turnip Crop. I. M. ROBERTSON. *Scot. Agric.*, 1957, **36**, 162–4.
7. Precision Seeding the Turnip Crop. J. M. MADDOX. *Scot. Agric.*, 1958, **37**, 181–4.
8. Recent Advances in Fertilizer Placement. J. W. S. REITH. *J. Sci. Food Agric.*, 1954, **5**, 421–8.
9. Varieties of Swedes. *N.I.A.B. Farmers Leaflet No. 7*. 1958.
10. Turnips—Seasonal Notes. R. BAIN. *Scot. Agric.*, 1956, **35**, 226–7.

"Agriculture" Index

The Index to Volume LXV will be issued with the April number.

The Battle against Blight

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Since 1952 a series of detailed scientific papers on the work going on against potato blight in this country has been published in the Ministry's quarterly journal *Plant Pathology*. The article below discusses some of the problems of protective spraying in the light of the knowledge that has been gained.

IN 1958 we had one of the worst blight years in living memory. On King Edwards in the Fens and parts of the West Midlands it was more like a blight year in the west of Ireland than anything we are accustomed to in the main English potato-growing areas. In some districts general outbreaks of the disease on the unsprayed potato foliage started in the first few days of July, and haulm which should have grown on into September was killed by the beginning of August.

The maps in Fig. 1, from the country-wide N.A.A.S. survey made in 1958, show the extent to which the two principal maincrops—Majestic and King Edward—were affected by blight (when left unsprayed) in different parts of the country in this exceptionally bad blight year. In Fig. 2, maps for two earlier years are given for comparison. The key to the interpretation of these maps is that where growth was stopped by blight at the end of August, the probable average loss due to premature defoliation was about 1½ tons per acre on a 10-ton potential crop; where the stoppage was in mid-August the corresponding loss was about 3 tons; and where it was in early August it was up to 5 tons, or approaching half the crop.

In most blight years in England and Wales the rain which favours the blight also favours the growth of the potato plants, so that the national yield per acre tends to be higher in the blight years than in the drier years when there is little or no blight in most areas. This beneficent overall effect of abundant rain was not experienced in 1958. There was indeed too much rain. Many crops suffered from waterlogging in June; and this, as well as retarded growth of many crops in the north owing to the cold spring, adversely affected the general level of yields. Protective spraying was also often held up, because of the difficulty or impossibility of getting over the wet ground with tractor sprayers, and although aircraft came valiantly to the rescue, there were many unavoidable delays.

Good commercial spraying, in most blight years, can be expected to give on average about two weeks' prolongation of the useful growth of the haulm. Thus where growth is stopped by blight in the unsprayed crops by mid-August, it will not be stopped in the well-sprayed crops until the end of August. The gain on a 10-ton potential crop will be about 1½ tons per acre, and on a 15-ton potential crop about 2¼ tons per acre. Sometimes, with the help of good weather in the latter part of the season, the spraying does rather better than this; sometimes the gain is not quite so much; but two

weeks' prolongation of growth is a fair average. Usually, at any rate with Majestic, this gain can be achieved with two, or at most three, thorough and well-timed sprayings.

In 1958 much of the spraying did give the two weeks' prolongation of growth that could reasonably be expected from it, but with the interminable rain so rapidly washing the spray deposits off the leaves, it demanded more applications than usual. Even so, some of the spraying failed to give anything like two weeks' gain, and this disappointment was experienced particularly by the King Edward growers. About 30 per cent of our maincrop acreage was made up of King Edward and other red-skinned varieties in 1958; the other 70 per cent were white-skinned varieties, predominantly Majestic.

No one can say how often a year like 1958 is likely to recur—perhaps once in twenty years, perhaps only two or three times in a century. But on the basis of a detailed study of the survey maps for a ten-year period it can be said that seasons in which most of the unsprayed maincrops are killed by blight by or before the end of August—the seasons in which protective spraying is worth while—occur six or seven years out of ten in the Fens, almost every year in Devon, Cornwall and the Welsh coastal areas, five years out of ten in most of the rest of the country south of the Humber, and less than one year in ten in most of the north.

Two sides to protective spraying

After our experience in 1958, it is difficult to envisage that 1959 may be a dry year, in which there is little blight. But as the above reckoning shows, the chances of a "blight" or a "no blight" season in 1959 at any rate over much of the south of the country, are about fifty-fifty. And it is as important to avoid spray damage in the dry years when the crop is light as to secure really efficient protection in the wet years, when often (but not always) the general level of yields is high and there may even be a glut, as in 1953 and 1956.

In the dry seasons, spraying may cause loss of crop, not only by wheel damage from the passage of ground machines but sometimes also by copper injury to the foliage, particularly after aphid attack. It would be wrong to suggest that these losses are generally very great. To think of the wheel-damage loss as amounting on average to 3 per cent of the crop in all seasons, and of the copper-injury loss as another 3 per cent in dry seasons only, probably puts these losses into the right perspective. They are soon offset by gains if there is any useful prolongation of growth from blight control; but where there is no blight or it comes late, these losses from spray damage may be real enough—on top of those from drought.

The best that can be done to reduce dry-season losses is to avoid spraying where there is little likelihood of its doing good. Also, nowadays there is the possibility of using zineb for the early sprayings to evade copper injury, and aircraft for the later sprayings to avoid wheel damage to sprawling haulm.

But where protective spraying is going to be done at all, the first requirement is that it should really protect the haulm, if a severe blight attack develops. For this there are two needs, both equally important. First, the whole of the foliage must be well covered by spray deposits when general outbreaks of the disease begin in the district; and then the deposits must be

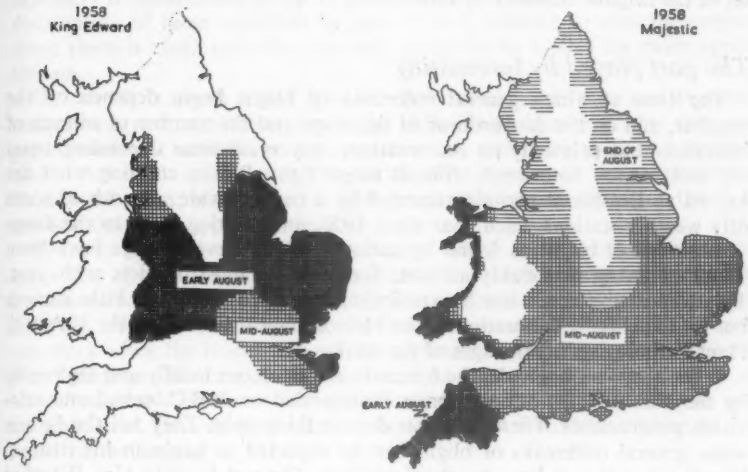

Fig. 1. Survey maps showing when growth was stopped by blight in most unsprayed King Edward and Majestic crops in 1958.

Fig. 2. Similar maps for the previous "blight year" 1957 and for the dry year 1955. These maps are for both King Edward and Majestic. The King Edward generally came into the earlier parts of the fortnights indicated, Majestic into the later.

renewed as necessary to protect new growth, and to make up for the washing off of the original deposits by rain.

The part played by forecasting

The time at which general outbreaks of blight begin depends on the weather, and on the forwardness of the crops and the number of sources of infection—but primarily on the weather. Any predictions depending upon our weather are notoriously difficult to get right. But by charting what are known as Beaumont periods, recorded by a country-wide network of some fifty weather stations, each year since 1950, and relating them to the times of outbreak of blight as found by national blight surveys, ways have been found of giving reasonably accurate forecasts for most districts each year. This forecasting needs much experience, and there would be little success but for the close collaboration of the Meteorological Office and the N.A.A.S. Plant Pathologists in all stages of the work.

When they can be made, the forecasts are given out locally and regionally by the N.A.A.S., by national press notices, and on B.B.C. sound and television programmes. These forecasts do one thing only. They tell the farmer when general outbreaks of blight can be expected to begin in his district. Usually they give at least ten days' warning. The rest is up to him. Whether he should spray or not depends on his spraying policy, the value of his crop, and many other considerations outside the scope of forecasting. Farmers who want advice on spraying should consult their local N.A.A.S. officers.

The forecasts serve well to indicate the right time for the important spraying that is to protect the whole of the foliage when the real attack begins. After that—and let it be said plainly—forecasting can give little help. The next and subsequent sprayings should be given according to the incidence of rain. No hard and fast rule can be laid down about the number of applications required. It depends on the efficiency of the spraying, the amount of rain, and the time at which the first critical application has to be given. On Majestic, when it happens that the first spraying is not needed until the latter part of July, two sprayings 2–3 weeks apart are generally enough. Where the first application has to be given early in July, three applications may be needed, and it is noteworthy that the last, well on into August, may pay very well, if there is the growth left to justify it.

On King Edward in a really wet season in the Fens and parts of Lincolnshire, applications may be needed at 7–10 day intervals from the beginning of July to mid-August. In these areas, where six or seven years out of ten can be expected to be blight years, there is much to be said for a first routine spraying of the King Edward in the first week of July; but even where routine spraying is practised, a close watch should be kept on the forecasts to ensure, as far as possible, that one or other of the routine applications goes on just in advance of the general outbreak.

Machines and materials

There is no doubt that thorough spraying with Bordeaux mixture gives the longest protection under the conditions of a severe blight attack. Following this come similar applications with the copper oxychloride or cuprous

oxide sprays, using the higher recommended rates of application where necessary to compensate as far as possible for the faster washing off and redistribution of these materials by rain. It is a mistake to stint the copper when there is much rain, for that only gives rise to a need for more applications.

On the whole, zineb sprays appear to have done better than was expected under the severe conditions of trial in 1958. They deserve further use, not yet in wholesale substitution for copper, but to determine their real potentialities under our conditions. The Dutch, who have used them extensively for several years, now favour a split programme using zineb for the first applications and copper for the later.

So far as can be judged up to the present, air spraying is not equal, application for application, to the best and most thorough ground spraying. But it seems to be about equal, in point of efficiency, to the general run of ground spraying, with the advantage, so clearly demonstrated in 1958, that aircraft can work when the land is too wet for ground spraying. They also eliminate wheel damage. The main drawback to their use with the limited fleet of aircraft available, is that it is more difficult to get the spraying done at just the right time. Ground machines can be used more flexibly according to the needs of the season.

Early precautions

Blight starts each year from blighted shoots arising from blighted tubers planted or left in the ground. The proportion of blighted tubers which produce such shoots is very small—often only one or two in maybe a hundred acres. The first blighted shoots are inconspicuous, and it is hopeless to try to find and eradicate them in time to do any good. It is, however, very important to avoid as far as possible the planting of blighted seed; and to be quite rigorous in the clearing up of clamp sites.

Some farmers, particularly those who grow King Edward in districts that are bad for blight, like to get in an extra precautionary spraying in June, well in advance of the forecasts. There is no harm in such extra early spraying; the case against it is that it may use up an extra spray application which would generally give better return if it were put on later in the season. It covers only the foliage that is present when it is done, and may give a false sense of security. Whether an extra early spraying is given or not, a good spraying to cover all the growth is needed just before the general outbreak of blight (as indicated by forecasting) and further sprayings must be given to make up for washing off by rain if the disease is to be effectively controlled in a bad blight year.

Blight in the tubers

This article is about protective spraying. There is room for only a few remarks about blight in tubers. First, tuber infection can occur over the whole period during which there is any blight on the haulm. Thus the longer protective spraying can keep blight off the haulm, the better for the tubers. Second, a year in which the haulm is killed off rapidly by blight is not necessarily a bad year for blight in tubers; one of the natural compensations

for loss of crop by premature defoliation is that some of the later infection of the tubers is prevented. The general level of blight in tubers in 1958 was somewhat higher than in 1957, but not greatly so. Lastly, varietal susceptibility is the main factor affecting the occurrence of blight in the tubers. The proportion of blighted tubers is, in general, about three times greater in King Edward than in Majestic.

Mechanical Damage to Potatoes

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Merchants are becoming increasingly worried by the amount of damaged potatoes they have to handle, and farmers are often asked to be very careful at all stages of harvesting and storing the crop. Much of the damage is attributed, rightly or wrongly, to the machines harvesting the crop.

THERE are three main kinds of damage likely to be sustained by potatoes during harvesting, and all three can be reduced if machines are properly adjusted and carefully handled. First, the share of whatever machine is being used for digging can cut the potatoes badly. Second, light knocks and scrapes can remove part of the skin of the potato and cause surface damage. Third, sharper knocks produce deep, internal cracks in the flesh of the tuber, and it is these cracks that probably have the worst and most lasting effect, although they are at first almost invisible and can be seen only by very close inspection of the tubers. Some of these kinds of damage are more likely to occur when the potatoes are turgid after a spell of wet weather.

Even at planting time, the preparation of the land and the placing of the seed can influence the possibility of damage when the crop comes to be harvested. Soil should be worked as deep as can be managed, ridges should be shallow so that the soles of the ridging bodies still have some inches of cultivated soil beneath them. When the ridges are split back to cover the potatoes the bodies should be set deeper, so that the tubers are well covered, but nevertheless are placed high in the ridge; then at harvesting time the share of the spinner or digger can be set to run below the crop without running in the subsoil, and separation of the tubers from the soil is possible with less risk of damage to the potatoes.

Planting depth should be about the same all over the field, so that there shall be as little variation as possible in the depth reached by the crop, otherwise it is impossible to adjust the harvesting machine correctly.

Adjustment of harvesting machinery

There are some general precautions to be observed before and at the time of harvesting which apply to spinners and elevator diggers alike. In the

harvesting itself, although slow forward speeds do not necessarily reduce the risk of damage by the machines, it is certainly best not to hurry the handling and transport of the potatoes too much. In the preparations for harvesting, any mechanical haulm cutters that are used must be very carefully adjusted so that they will not damage shallow tubers before lifting.

To keep the amount of damage as low as possible, the shares of spinners should be set just deep enough to take all the crop without taking too much soil. Tines should be set not too far behind the share, and it is important that they should all be as deep as the share so that their ends do not knock any potatoes. While the spinner is at work it is as well to examine the harvested crop at times, to see whether there are signs of surface cuts or skinning. The tines should be adjusted if signs of this are seen. If the potatoes are lightly skinned or have shallow cuts, the ends of the tines are striking them. The remedy is either to lower the tines in relation to the share or, if there is more than about a one-inch gap between the back of the share and the tines, it should be closed a little. Deep dents in the potatoes, and crushed flesh, indicate that the tine speed is too high and must be reduced. Screens fitted to the spinners to prevent spread and to windrow the potatoes should be made of string net. Galvanized riddle wire used for this purpose can damage the tubers very severely, because they are thrown against it with considerable force.

Some observers believe that the increase in prevalence of damage to potatoes is due in part to the wider use of elevator diggers, and therefore it is worth while to examine the methods of operation of these machines and to see where damage may be caused and how it can be prevented. As with spinners, it is important that the share shall be deep enough not to cut any potatoes. The speed and movement of the web, and the amount of its agitation, should be adjusted so that some soil is kept on the web to fall from the back with the potatoes. The force of any impact upon the potatoes varies with the web speed; a high speed web causes more damage than one moving at a lower speed. The higher the speed, the greater also is the agitation, but it is to be noticed that the amount of shaking can be controlled independently of the speed by fitting agitators of different shape, or if agitation is not needed at all, by using plain rollers.

The speed of the web can be adjusted in some machines by altering the ratio of the gears in a gear-box. In other machines the relation of the speed of the web and the forward speed of the harvester over the ground can be changed by selecting different combinations of engine speed and tractor transmission gears.

Elevator diggers that do least cleaning do least damage. The soil itself can act as a protecting cushion, but the amount of soil carried with the potatoes varies with the condition of the soil. Soil that is powdery drops through quickly; if it is damp it stays longer with the potatoes. In fine soil the machine should always be adjusted for minimum agitation.

The forward speed of a digger does not always have a great influence on the amount of damage done to the potatoes. On light soil a high forward speed brings less damage than a slow forward speed, because the soil stays with the potatoes further along the web. This overloading may be essential with dry sandy soils to prevent damage.

Some elevator diggers are so designed that the web can be set to run either

in one length or in two separate lengths. In such machines the web should be run in one length to avoid damaging the crop, and only on wet or heavy soils should it be necessary to run the web with a drop from the front elevator on to the rear separate elevator. The drop does help separation of potatoes from the soil but it increases the risk of damage to them.

When complete harvesters are used an additional point has to be watched: the arrangements for dropping the potatoes into the trailer alongside the machines should be such that the damage inevitably caused by the drop is as little as possible. Bags stuffed with straw and placed on the bottom of the trailer under the delivery of the harvester, will do something towards breaking the fall of the tubers before they roll on to the floor of the trailer. Covering the trailer floor with a layer of straw about 6 inches deep, placing a canvas sheet over this layer and tacking it down at the edges to form a cushion over the whole surface of the trailer is another method of minimizing the damage. Experiment has shown that potatoes can usually be dropped from a height of three feet without damage on to other potatoes, but only one foot on to a wooden plank.

Transport and damage

The carting of the potatoes must be done carefully and without haste to preserve potatoes carefully harvested. Some kinds of tip-carts are really not at all suitable for depositing potatoes on a heap. Potatoes already tipped and in the heap can easily be damaged by the rear edge of the cart and by any bearers which protrude behind the rear edge. Loading and off-loading into motor lorries can also cause damage. At clamps as well as at depots and markets, sacks of potatoes are sometimes dumped on to hard floors from quite excessive heights.

Stepping on potatoes in trailers or walking over the bulk in a store can cause damage to individual potatoes, both by abrasion and by crushing. Crushing is more serious than abrasion because deep, open cracks are formed which allow soil to enter. Workers should try not to walk on clamp sides or on the tubers in a bulk store. When clamps come to be rounded up before strawing, rough forking can pierce many of the potatoes. Another time of danger is when potatoes are forked into the riddle at bagging. When potato forks get worn to sharp points, they are much more likely to damage the potatoes.

Where potatoes are to be kept indoors or in clamps, great care should be taken while tipping them on to the ground or into elevator hoppers to see that they are not crushed or scraped. Elevators should be adjusted so that potatoes never have to drop more than two feet. The delivery point from the elevator should be moved about, so that cones of soil do not form and cause areas that will never be ventilated properly. This is particularly important when the soil with the potatoes is only lightly adhering to them. When choosing an elevator for potatoes it is important to make sure that the point of delivery from the elevator can be swivelled easily in a horizontal arc, and that its height can be adjusted through a range from two feet from the ground. When an elevator is used for potatoes, the overhang should be measured and the height of delivery limited to a figure two feet less than the overhang, so that when the pile of potatoes has attained its natural angle of

repose, the edge of the heap is free of the wheels and framework of the elevator.

Care is necessary also at the time of sorting the potatoes if they are not to be damaged by knocking or skinning. Here again the use of rubber strips at points of contact can provide useful cushioning, but greater care in forking the potatoes from the heap on to the sorter would probably best reduce the damage at this stage. Mechanically operated riddles must not be worked at too high a speed. The amount of damage caused tends to rise with increased speed of running. Suitable adjustment of the feeding and delivery mechanism is also an important factor in keeping damage to a minimum.

Although there is always good reason for preventing injury to potatoes to ensure that they store well, it is only by washing and thoroughly brushing them for prepackaging that damage to the tubers becomes fully apparent. If prepackaging is to be successful without too large a proportion of discarded tubers, then every care must be taken throughout the harvesting process. Even the brushing of the potatoes must not be done too vigorously.

Timing Sprays for Control of Pea Moth

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Many growers have failed to control pea moth probably because they sprayed too early. As a guide to the timing of sprays, flowering is of limited use; the time the moth appears is most important.

PEA moth or pea maggot, as it is sometimes called, is one of the most familiar pests of peas. The adults normally emerge from cocoons in the soil and may be found in pea crops from about the third week of June until mid-August. The eggs, which are difficult to see, are flattened and oval in shape and are laid on the leaves and stipules of the plants. The newly hatched caterpillar is very active and crawls over the leaves, eventually boring into a pod, where it feeds on the developing seeds. When fully fed, the larva leaves through a hole cut in the pod and drops to the soil, where it spends the winter in a cocoon.

A survey of pea crops in Essex and the Isle of Ely in the summer of 1957 showed that many pea growers were not controlling pea moth satisfactorily with one, or in some cases two, applications of DDT. In Essex, eight fields of Harrison's Glory sprayed with DDT had an average pod infestation of 23 per cent, compared with 21 per cent on twelve unsprayed fields. Most of these crops were drilled in the last week of March or the first week of April, and the first DDT spray was generally applied during the third week in June,

which coincided with the flowering stage of Harrison's Glory. The most likely explanation of the apparent failure of DDT to control pea moth was that the timing of the sprays was wrong.

Field trials in 1958

To investigate the effect of the timing of sprays, and to compare DDT with several other insecticides, two trials were laid down in 1958 near Saffron Walden. The first trial was carried out on a field of Harrison's Glory peas drilled on 21st March, near a field heavily infested with pea moth (30 per cent pods attacked) in 1957.

The treatments were:

Materials	Rate *per acre*	Date of application	Concentration of insecticide *per cent*
15 per cent DDT emulsion	13½ pt in 100 gal water	18th June, 4th July	0·25
" " " " "	" " " " "	18th June, 4th and 18th July	0·25
" " " " "	13½ pt in 5 gal water	18th June, 4th July	5·0
20 " " parathion	1½ pt in 100 gal water	" " " "	0·0375
32 " " Rogor*	1 pt in 100 gal water	" " " "	0·04
20 " " endrin	$\frac{4}{5}$ pt in 100 gal water	" " " "	0·02
No sprays (control plots)			

All treatments were replicated four times and applied to plots of 10 by 16 yards. The high volume sprays were applied with a Land Rover, which was parked on the headland and the plots sprayed with a hand lance, care being taken to prevent damage to the crop by the hose. The 5-gallon applications of DDT concentrate were made with a portable mist-blower.

The weather conditions during spraying were good, but heavy rain fell a day after the first spray and a few hours after the second. (Four inches of rain fell between the first and second sprays, 2 inches between the second and third DDT sprays and 2·4 inches between the third DDT spray and harvesting.)

At the time of the first application, on 18th June, the crop was in the late-flowering stage with pods beginning to develop. No pea moth had so far been found on the field, but pea fields in the district were already being sprayed. The third application of DDT was made on 18th July when pods were well developed, but mainly in the flat stage. Samples of 100 pods per plot were collected at random from upper, middle and lower parts of the plants on 29th July when the peas were still green. These pods were examined in the laboratory on 29th and 30th July. Records were made of the number of pods with larvae, and the larvae present were grouped on the basis of size and amount of feeding into four arbitrary stages.

* 0,0 dimethyl S (N-methyl carboxamido methyl) phosphorothiolothionate.

Results

Detailed results of infested pods and the larvae present are given in the following table:

Infestation of pea moth at green picking stage (29th July)

Treatment	No. of pods infested with pea moth (400 pods examined)	Average infestation per 100 pods	No. of larvae of each "stage"/400 pods				Total
			1 up to 1½ mm	2 1½–3 mm	3 3–5½ mm	4 Over 5½ mm	
2 DDT sprays	54	13·50*	5	41	11*	6*	63
3 DDT sprays	27	6·75*	1	12*	15*	1*	29
2 concentrate DDT sprays	51	12·75*	3	38	14*	7*	62
2 parathion sprays	64	16·00*	4	43	19	6*	72
2 Rogor sprays	67	16·75*	1	55	14*	6*	76
2 endrin sprays	84	21·00	8	44	32	6*	90
Control	94	23·50	6	46	32	19	103

* Significantly lower than controls.

The results show that there was a moderate attack of pea moth, the control plots having an average of 23·5 per cent pods infested. All treatments except endrin significantly reduced the infestation, and the three sprays of DDT at high volume were significantly better than all other treatments. More information can be obtained by comparing the number of larvae of different stages. It should be remembered that Stage 4 larvae are the oldest and come from the first eggs which were laid, while Stage 1 are the youngest larvae, which come from eggs laid very much later. The following conclusions can be drawn:

On all treatments, there are significantly fewer Stage 4 larvae than on the controls. This shows that all treatments were effective at the beginning of the attack.

The number of Stage 3 larvae is the same on endrin as on the control plots, and is significantly lower only on the DDT and Rogor plots. This rather suggests that endrin was less persistent than the other two materials.

The number of Stage 2 larvae was significantly reduced only on plots receiving three DDT sprays. There was no real difference between the other treatments and the controls. It was the third DDT spray which protected the crop against what appeared to be the peak of the attack, as 44·6 per cent of the total larvae found on the control plots were second-stage larvae. The peak egg lay must, therefore, have occurred just before the last DDT spray.

In the second trial, which was carried out on the same field and on plots adjoining the first, DDT sprays were applied on 24th June and 10th July, each six days later than in the first trial. The plots were smaller (8 by 8 yards), and replicated five times. Samples of pods were collected on 29th July by removing all the pods from ten plants taken at random from each plot. The results showed that there was an average infestation of 6·0 per cent on the plots sprayed with DDT, compared with 21·3 per cent on the control plots. Again the two DDT sprays significantly reduced the damage, but the results obtained were much better than in the first trial, where 13·5 per cent pods

were attacked on plots receiving two sprays of DDT; in fact the control was as good as that obtained with three DDT sprays in the first trial. Since both trials were on the same field, and as the attack on the untreated plots was very similar, the better control obtained in the second trial was very likely due to the later date of spraying.

The trials have confirmed that DDT can be reasonably effective against pea moth. The same probably applies to Rogor and parathion, but Rogor is slightly more expensive than DDT and parathion is more toxic to mammals and is included in the Agriculture (Poisonous Substances) Regulations. DDT applied as a concentrate spray at five gallons per acre was as good as the high volume application, and suggests that concentrate spraying is well worth further investigation.

Timing of sprays

As has already been suggested by Wright and Geering,* the correct timing of sprays is of great importance. The results obtained in the first trial, and in particular the examination of the larval populations, indicate that two DDT sprays applied on 18th June and 4th July gave initial protection but failed against the later attack, as shown by the number of Stage 2 larvae present; a significant reduction of these was obtained only with the third DDT spray applied on 18th July. The second spray must have been applied at the time when the now more mature larvae (Stages 3 and 4) were entering the pods, and the first spray when little or no attack was taking place. This conclusion is supported by the improved results obtained with two later sprays in the second trial and by observations made in the field. No moths were seen in the field at the time of the early spraying on 18th June, and the first pea moth larvae were found in Essex on 1st July. The first adults emerged from cages at Cambridge on 25th June.

The results help to explain why growers have often obtained such a poor control of pea moth. The practice has been to spray all but the very early-sown crops soon after flowering has commenced, without regard to the presence or absence of pea moth. This is likely to be correct for crops sown in late April or May, but as these trials have shown, confirming the work of Wright and Geering, it would have been too early for crops sown at the more usual time in March or early April. It seems, therefore, that the date of flowering has limited use alone in determining the correct time of spraying, and more attention must be paid to the presence of pea moth in the crop. By field observations we intend to find out when the moths appear, and this information will be available to growers through their N.A.A.S. District Advisory Officers, who should be consulted for further details. Together with knowledge of the stage the crop has reached, it will then provide a proper basis for the timing of sprays.

We wish to thank Mr. W. Gordon Tinney, Mitchell's Farm, near Saffron Walden, for his co-operation in these trials. We are also grateful to Dr. H. C. Gough for his interest and advice.

* The Biology and Control of the Pea Moth, *Laspeyresia nigricana*. D. W. WRIGHT and Q. A. GEERING. *Bull. ent. Res.*, 1948, **39**, 57–84.

Eradicating Bovine Tuberculosis in the Irish Republic

P. CROWLEY, M.R.C.V.S.

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Last month Mr. T. E. Christie described the progress of the campaign to eradicate bovine tuberculosis from Northern Ireland. Mr. Crowley shows what is being done over the border to remove the scourge of this disease.

THERE are 4½ million cattle in the Irish Republic—1¼ million cows, 18,000 bulls and the rest mainly store animals and calves—on about 300,000 agricultural holdings. The average herd varies from 22 animals in Munster, where the economy is primarily dairying, to 10 in Connacht, where mixed farming on small holdings predominates. (The average attested herd in Great Britain contains about 40 animals.) The value of live cattle exports in 1957 was approximately £45 million out of total merchandise exports valued at £132 million. Store cattle exported to the United Kingdom numbered 747,000, worth over £40 million. About 55–60 per cent of the calves are produced in the seven dairying counties of the south, and considerable numbers of them are moved to farms in the west of the country and from these farms to the midland areas for finishing. The Irish economy, which at present derives very considerable support from store cattle exports, is adjusting itself to the progress of eradicating tuberculosis in Great Britain. The Department of Agriculture is operating measures, with the co-operation of the farming community, various associations of livestock interests and the creamery industry, to provide store cattle with the status required by the export trade.

Because of the small size of the average herd, the internal movement of cattle and the preponderance of store cattle output, the Irish approach to eradication must primarily be on an area, rather than on a herd, basis.

Development of the Scheme

Our Bovine Tuberculosis Eradication Scheme was introduced in September, 1954. The areas initially selected were Co. Clare and Co. Sligo and "Greater Bansha" in Co. Tipperary, where there had been a small pilot scheme for some years. These areas are representative of the conditions in the three main regions, other than the midland counties, where cattle are brought to forward condition for export. At the start, the Scheme in the three areas named provided the following facilities: free tuberculin tests and veterinary advice, purchase by the Department of reactor cows at current market value, and supervision by the State Veterinary Service. A local office, with administrative and technical staffs, was set up in each district.

Because of the degree of progress achieved, it was decided to declare Co. Sligo a clearance (eradication) area as from 1st November 1957, and this was followed by the declaration as clearance areas from 31st March 1958,

of Counties Clare, Galway, Roscommon, Mayo, Leitrim and Donegal, making a compact clearance area of seven counties bounded by the River Shannon and the border between the two parts of Ireland. The number of cattle in these seven counties is 1¼ million, including 300,000 cows. By the end of 1957 over 107,000 of the 123,000 herd-owners in the area had already come into the Scheme voluntarily, and nearly a million animals were under periodic testing. Eradication is compulsory when a district becomes a clearance area. All the necessary tuberculin testing is free and all reactors of all types are now removed, under compensation, as soon as they are discovered. There is also statutory control over the movement of cattle into the area and between herds within it. The intention is to establish Sligo as our first accredited area in 1959, and to follow this by accrediting the six other counties in the area in 1960.

The incidence of the disease is not high in the two dairying counties of Cavan and Monaghan in the north, and much progress towards eradication there has already been achieved. Circumstances in the neighbouring county of Longford are also favourable: it is therefore intended to advance these three to clearance area status in a relatively short time, and it is hoped that they will be accredited areas by the end of 1960.

An order which came into force on 1st January 1958 requires all skim milk returned by the creameries to their suppliers to be pasteurized. This should minimize the danger of spreading bovine tuberculosis, as well as other livestock diseases, through the medium of this milk.

Main dairying counties

The gravest problem facing the Irish Government in ridding the country of bovine tuberculosis lies in the six main dairying counties, Cork, Kerry, Kilkenny, Limerick, Waterford and Tipperary. The incidence of the disease in cows here is over 40 per cent, and in other stock in proportion. The immediate steps being taken are to prevent the spread of infection through skim milk by pasteurization, to segregate the young stock in safe conditions, and to arrange for the removal of cow reactors according to the fastest programme the dairying economy can sustain. The first five counties named are already under intensive treatment, including free periodic testing and the purchase of reactor breeding stock by the Department. The necessary preliminary organization of County Tipperary, so that the same measures can be applied to it, is almost completed. The number of cattle in these six southern dairying counties is 1,800,000, including 600,000 cows—half the entire cow population.

Feeding counties

The remaining ten counties are all in the province of Leinster, and are mainly engaged in bringing younger stores from the west and south to forward condition for export. Interest in the Scheme and the awareness of the issues involved have recently reached a new peak throughout this area, following the recent announcement that the remainder of Britain has now been brought under free testing and that the end of its campaign is in sight by 1961. Many of the feeders in these counties are now confining their pur-

chases to tested animals, and as eradication proceeds in Britain a large number of them, particularly in Kildare, Meath and Westmeath, will perforce set up individually accredited herds in order to preserve their store market outlet. Intensive eradication measures now apply to these ten counties.

Accredited Herds Scheme

On 1st November 1956, an Accredited Herds Scheme was introduced, based on the proposals of the National Farmers' Association. This operates throughout the whole country, to help any herd owner who wants to eradicate the disease from his herd and reach accredited status. Herds attaining the strict standard prescribed are officially registered as accredited herds. These standards are equivalent to those of attested herds in Great Britain. By agreement with the British authorities, such accredited stock will be allowed direct entry—subject to conditions as regards certification and transit—to their attested herds or areas.

There has been a steady increase in the number of herds qualifying for accreditation in recent months, and some shipments of accredited cattle have already taken place.

Transport and marketing

Because of the extent to which movement from district to district takes place during the normal cycle of rearing, the question of transport and marketing poses very special problems which, with the development of the Scheme, now require organization and statutory control. Full authority to do this is contained in the Diseases of Animals (Bovine Tuberculosis) Act, 1957, which gives comprehensive enabling powers to the Minister for Agriculture to deal with all aspects of eradication.

Discussions have been held and arrangements settled with the shipping companies for the segregation of accredited cattle in the cross-channel trade, by approved routes. Movement in connection with the internal trade with Northern Ireland will be similarly safeguarded.

Night Call

The gusty spattering of rain against the window has been like the scampering of frightened mice. The ashes of the crumbling fire occasionally sizzle in protest as a splash of water falls down the chimney. The farmer's last pipe is dying. His wife has already gone upstairs, and he is waiting only to see the late-night weather report on television before turning in. Then the ominous tapping on the door, the stirring of tired limbs and the cowman's report.

"I 'llow you'd better come over to the cow pen. I thought 'Princess' would have had her calf before now, but when I looked in just now she wasn't any further forward than she was at half-past six. Seems to me she's giving up trying."

Out into a wet and windy world, where the yellow light of the lantern dances to the blustering gale. Into the warm and suddenly still haven of the calving pen. Amber light falls on whitewashed walls and ceiling. The shadows are deep brown. The restless cow turns to inspect the two men with placid eyes which grow tormented as the rhythmic pains recur. The farmer goes across and rubs her flank, speaking soothingly.

"Lie down, old girl. Lie down."

"She will again in a minute," says the cowman. "The pains'll throw her."

Fortunately, she selects a convenient corner, and the men watch her through the next throes. The cowman is right. She is not using them as she should. Only two ivory-white front hooves can be seen of the calf.

"We shall have to help," the farmer decides.

Unhurriedly he fetches the bucket of warm water and the disinfectant, while the cowman retrieves from his secret cache the new nylon calving-rope, padded with chamois leather, which he persuaded the boss to invest in a few weeks ago. Thread it around the hooves. Wait for the psychological moment. Then the strain. The men sweat, the cow lies exhausted, but the calf is born. A big one, too—hence the trouble. It lies flat and motionless on the floor. There is no time for sentiment. The calf must breathe. With deft and incredibly swift movements, the cowman has cleaned the caul from its nostrils, has blown vigorously into its mouth, has slapped its sides and is raising its head. The calf, stung to protest at last against this cavalier treatment, struggles—and is alive.

"Princess" lies with her head extended, past caring about anything. They lift her head and move the calf so that she can see it. The light of life returns to her eyes. She calls to the calf, and looks at the farmer with sudden hostility!

The men sit on straw bales, talking quietly for half an hour, lending a hand now and again when necessary. The calf is licked clean. It struggles to its feet, a fine young bull which maybe we shall be seeing in the show-ring next year. It is safely sucking. The job is over, another night call has been satisfactorily taken; another miracle accomplished. Outside, the wind has blown the rain away. Back to bed. In the pen, another item for the June returns.

Ralph Whitlock

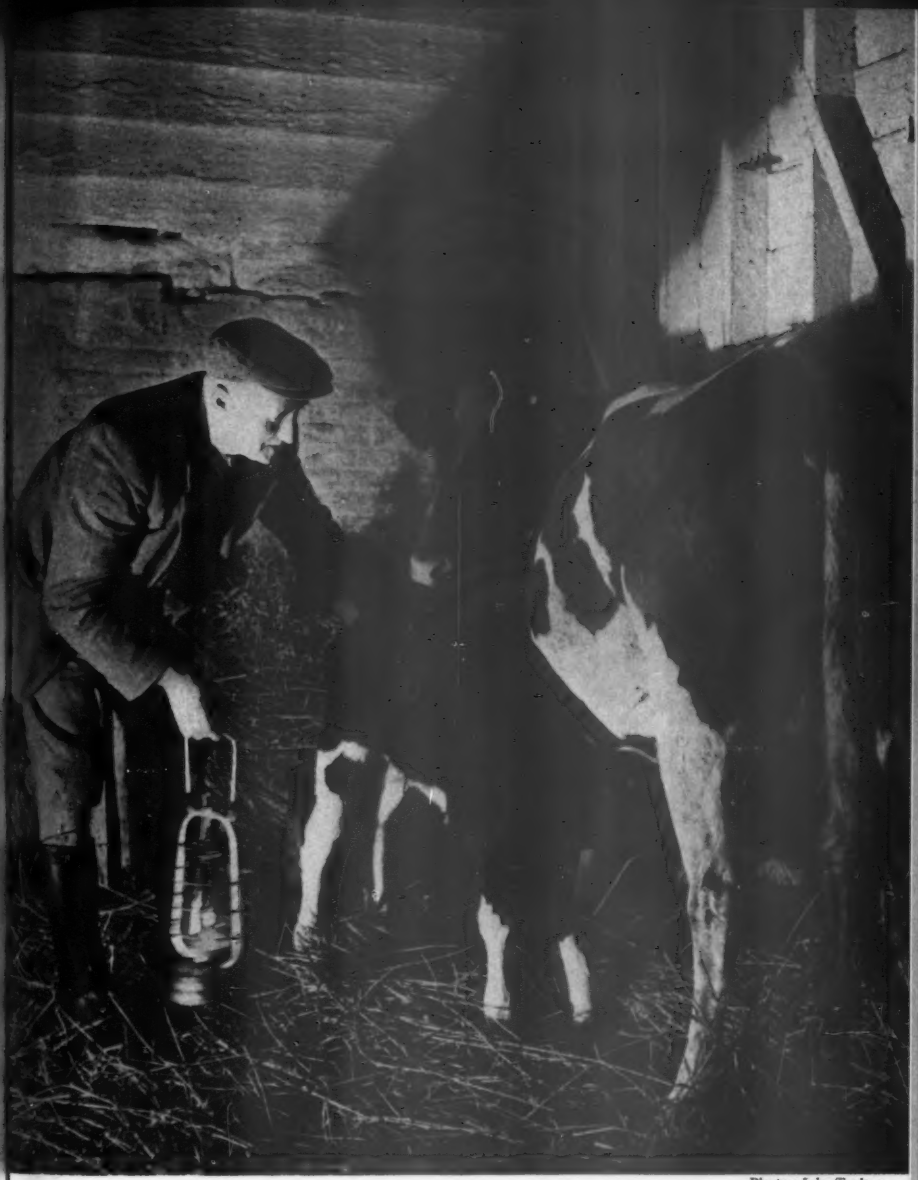


Photo: *John Tarlton*

Another item for the June returns.

The Battle against Blight (Article on pp. 603–8)

Photo: *Farmers Weekly*

Aircraft can work when the ground is too wet for ground spraying, but really thorough ground spraying is preferable where possible.

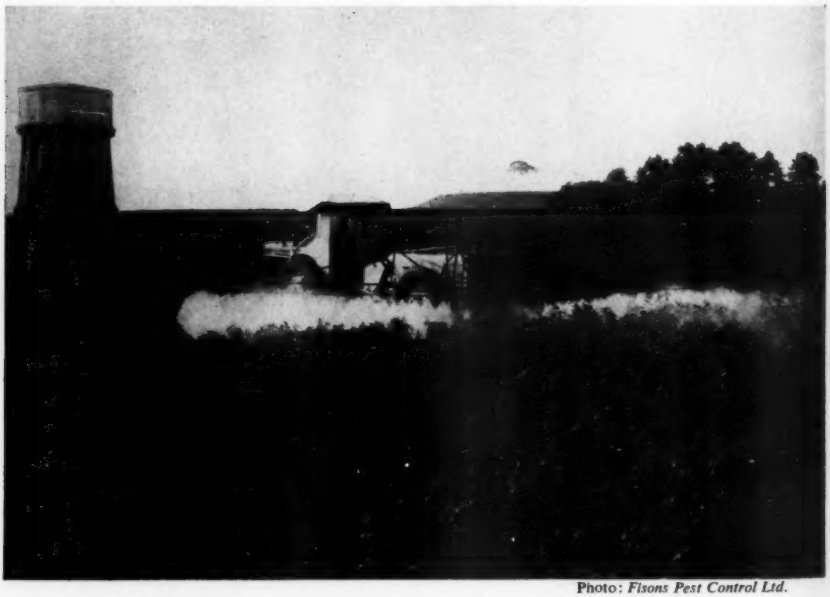
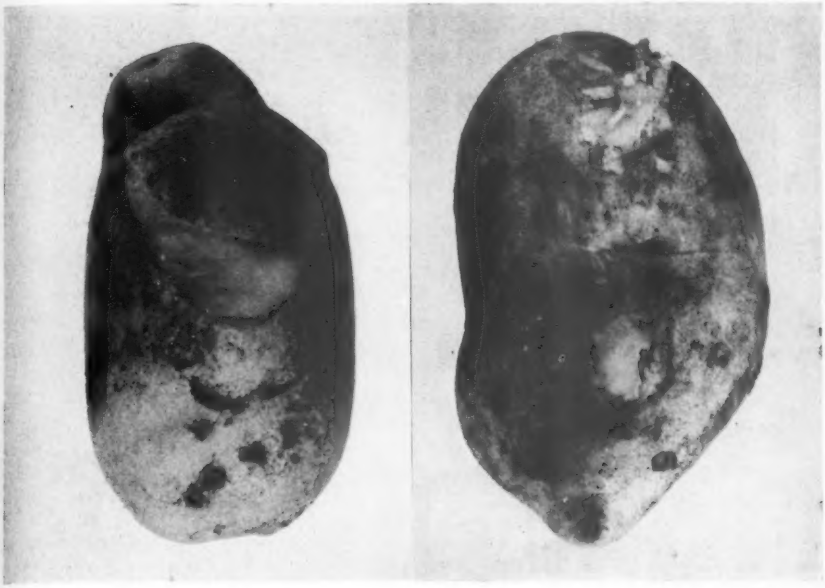


Photo: *Fisons Pest Control Ltd.*

High volume ground spraying with a 40-feet boom. Use of a wide boom reduces wheel damage.

Mechanical Damage to Potatoes (Article on pp. 608–11)

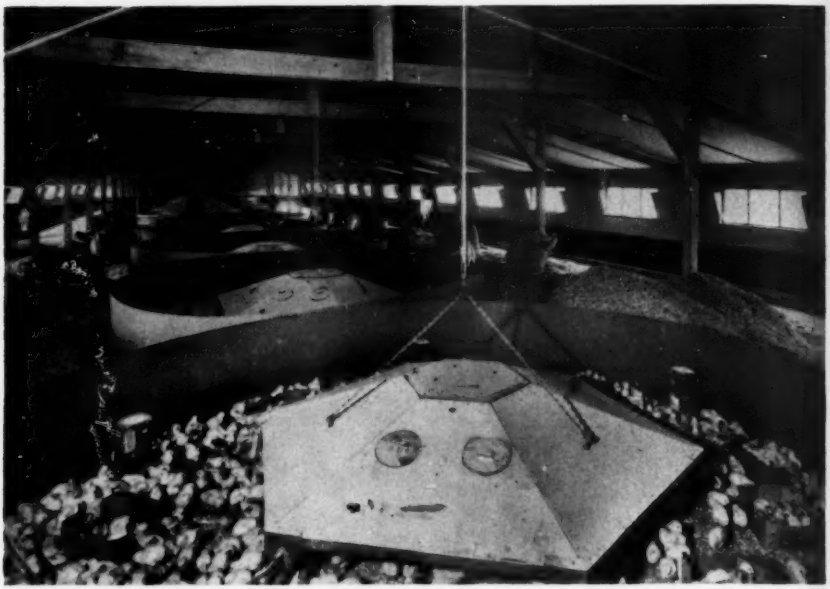


1 2

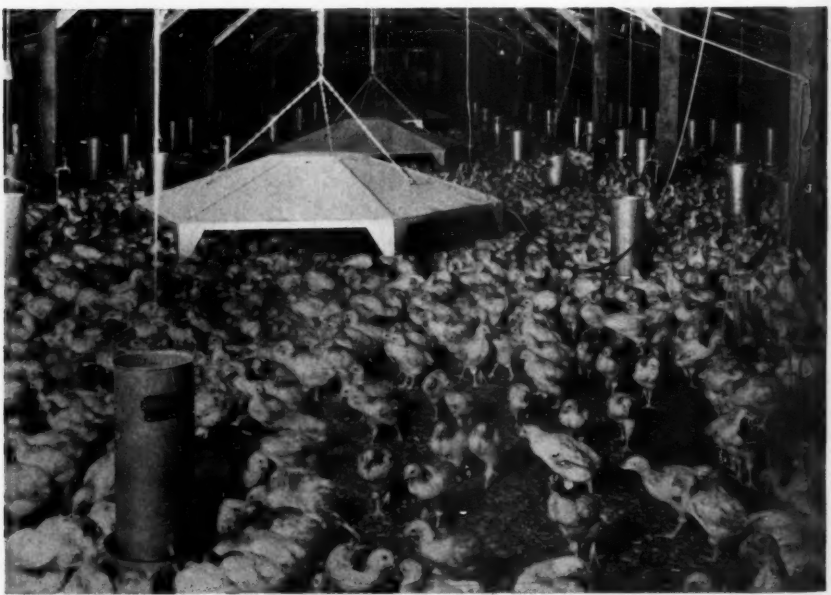
3

Careless harvesting can cause cutting and scraping of the kind shown in 1 and 2; and careless unloading deep cuts like those shown in 3, which produce more serious internal damage than is outwardly apparent.

Air Conditions in the Broiler-house (Article on pp. 629–34)



Week-old broilers under gas brooders. The surrounds reduce air speeds at bird level by 50 per cent.



Photos: *C. G. Payne*

These six-week-old chicks in a windowless house enjoy the advantages of gas brooders, tube feeders and automatic waterers.

Simplifying Farming Systems

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The thirteenth annual Oxford Farming Conference took place on 6–7th January: its theme, Simplifying Farming Systems.

ALL except one of the speakers at this year's Oxford Farming Conference were farmers and they spoke on the subject of simpler farming systems from their own experience. They neither dogmatized nor implied that theirs was the *only* way to farm. This is an important point. The system adopted should suit all the circumstances—size of farm, availability of resources, soil type, rainfall, altitude, etc. Some farmers may wish to concentrate on only one enterprise; others may prefer more, and be capable of doing them economically. Mr. Hough summed up the position when he said "There can be no merit in simplicity for its own sake. Whether we produce one article or a dozen on a big scale or a small, the important point is to be sure we are farming within our own managerial abilities, whatever these may be."

Farming is becoming more and more complicated and needs greater efficiency, and whilst simplification and specialization may pay some farmers, it is still as dangerous as ever to generalize on anything connected with the farming industry. Several points came out of the Conference which spell good husbandry and sound economics under any system of farming, and the papers presented may be reviewed under the following heads:

Effective farm layout

The necessity of making a plan for the better layout of the farm was stressed. Attending to the drainage was of first importance in Mr. Caudwell's case, providing access to all parts of the farm by making or improving the roads, and then attending to the buildings, improving or adapting according to circumstances—demolishing and starting from scratch, if necessary. Much of this work, naturally, demands good relationship between landlord and tenant, or owner occupation. Milk on the contract dairy principle was Mr. Cherrington's choice, with sheep and barley, grass seeds and kale for folding. Contractors are employed for fertilizer application and grain-handling, thus economizing in labour and reducing capital investment on machinery.

Mr. Caudwell gave a picture of "big business" very well handled, simplicity as a result of efficient planning, leading to maximum results with minimum costs. His farm operations are directed from a centrally placed office; each unit is in the hands of a specialist. The men are contented, well housed and enjoy piece-work rates for 80 per cent of their labours. Self-help in all departments of the estate is achieved by employing blacksmiths, mechanics, builders, etc., as part of the labour force.

Mr. Pritchard started with so little and has achieved so much. He has increased his stock gradually, concentrating on sheep and milk, and always

maintaining that it was better to invest money in four legs than in four wheels. He is a born stockman, as evidence his management of sheep, which he maintains will move forward for two reasons—food and freedom. On this maxim he built his sheep-handling pens, which enable one man to do all routine jobs. Likewise, in his milk production he recommends having one more unit in the parlour than is considered absolutely necessary, maintaining that it is better to have a unit waiting for a man rather than a man waiting for a unit.

Specialization in milk production

Both Mr. E. M. Owens of Langford, Bristol, and Mr. D. Lead from Ashford, Kent, each on 90-acre holdings, emphasized the paramount importance of the grass crop and stressed the need for efficient production, conservation and utilization. High output demands high fertility, and therefore high fertilizer application is necessary, together with cutting or grazing at the right time —when the crop is ready and not when the climate allows. Mr. Lead maintained that the growth of good grass and the intelligent use of its full potential should be the foremost aim of every livestock farmer: there is no substitute for it at any time of the year. Silage, they agreed, was their answer to conservation, but it must be of high quality, both in dry matter and nutritive value. (Barn hay drying may eventually become common practice.)

While Mr. Owens favours the buck-rake as still the simplest and cheapest method, Mr. Lead uses the forage harvester, plus an elevator at the silo. Self-feeding *ad lib.* suits their conditions, and is satisfactory for yields up to 1,000 gallons per cow per year. Above this figure, greater personal attention would be necessary to maintain higher yields. Mr. Owens suggested that self-feeding of silage *must* be made to work, and it *must* be under cover. Among the gains claimed for it are more milk as a result of greater comfort, and "little and often" feeding; a second gallon and, perhaps, protein for a third; an improved amenity of work; and a little less work, especially at weekends.

Of course there are problems. Straw is expensive and scarce and can only be used for lying on. Strawing must be kept ahead of yard requirements so that the bed is firm and does not poach. The yard must be arranged so that the cows do not have to walk over the bedded area to the bail or silo. The exercising area and approach to the silo face must be cleaned daily, and there must be a free-draining floor—clinker and tile drains, not concrete.

Mr. Lead, after starting with several enterprises, finally decided on milk production, arguing that whilst an exceptional man might be master of all trades, he felt he would rather concentrate on one. He thought it a mistake to try a "little of everything" on *most* small farms. He further considered it a mistake to maintain a high ratio of non-productive to productive stock where the land is well suited and sited for intensive grassland management.

Both farmers use Italian ryegrass for early bite and their leys are based on timothy/meadow fescue/white clover mixtures. A figure of 600 gallons per cow per year from grass alone was quoted by Mr. Lead, who also stated that "the judicious use of concentrates is complementary to the optimum use of grass, and is in no way in opposition to it". He now proposes to increase his use of concentrates and cull his poorer cows.

Simpler arable and stock systems

Messrs. Hough of Langford Downs, Gloucestershire, and Fenwick Jackson of Kirkharle, Newcastle, dealt very capably with their own particular farming systems, each under very different circumstances of soil and climate. Both agreed on the value of a rotation. As Mr. Hough said, he "likes the discipline of a rotation". At Langford Downs, two separate rotations are followed: *Heavy land*—3 years corn, 3 years ley; *Light land*—2 years S.100 white clover and S.101 ryegrass seeded in both years; corn, sugar beet, 2 years corn, Cotswold late-flowering red clover for seed, corn undersown to ley. At Kirkharle, the rotation is 3 years corn, 1 year Italian ryegrass, 2 years corn, 3 years ley. Each stocks his grassland intensively with ewes and lambs, and emphasized the importance of clean land for the lambs. Sugar beet tops are valuable for Mr. Hough's ewe flock from November to January. But Mr. Jackson is completely sold on the value of silage for sheep. There are two golden rules: it must be palatable, and it must be of good quality. Regular dosing of sheep is recommended, once in the autumn and once in the spring, by Mr. Jackson. Mr. Hough, on the other hand, includes phenothiazine in his concentrates. Flushing is regarded as most important by both flock-masters.

Mr. Hough's other livestock enterprise is poultry, a quite separate unit, half in batteries and half in folds; the only connection with the rest of the farm being the barley they consume and the value they leave behind on the leys over which they are folded. Mr. Jackson has chosen cattle for a second livestock enterprise. Calves are purchased and reared for sale, either as stores or fat, in their second autumn. He practises early weaning, claiming for it easier management, cheaper autumn purchase of calves, and that the main demand for labour is in the winter.

Herbage seed and sugar beet are included by Mr. Hough to give a useful break in the corn rotation: they act as a good preparation for corn, provide valuable sheep grazing, and the threshed straw from the seed crops is reasonably good fodder. The beet crop also gives a high cash return when well done.

Good leys are most important and the practice of undersowing in a corn crop is to be discontinued because of the poor takes in recent years; a good establishment is the first essential, and this is more likely to be obtained if the seeds are sown alone. Whilst clover seed production is so precarious, it is well to regard it as of secondary importance in the scheme of things, and any clover seed as a welcome by-product of a good sheep grazing ley.

How work study helps in replanning a system

Mr. P. J. Smith of Oaken, Wolverhampton, gave an interesting picture of his farm and showed how, after deciding that fourteen enterprises were too many for one man—however vigorous—to manage, work study materially helped him in the planning for his final choice of five enterprises—namely, store cattle at grass, cereals, black currants, pigs and turkeys. The two enterprises which were the subject of work study were black currants and pigs. With the former, it resulted in a great saving of labour on pruning by having the job done "piece-work" and also on spraying, where, by having water

storage tanks placed at strategic points, 25 per cent more work was done in a day. In the pig enterprise, work study resulted in a two-thirds saving in time in the fattening house and three-quarters of the time on the sow unit. The result is that both units have been more than doubled and yet the pigman agrees that his work is easier and he has more time for stockmanship.

In addition, work study on the handling of grain and the milling and mixing of food has resulted in a further saving in time and labour.

Mr. Smith maintains that these investigations and the consequent work study outlook of both himself and his men, have made individual jobs more efficient and very much easier to carry out. Physical effort has been cut down to a minimum; it has taught him that what is simplest is best and often most profitable. His men have accepted work study, understanding that it is not being used to make them redundant but to make their individual enterprises more efficient. Work study has been used as an aid to management, and this is how it should be regarded.

Economic approach to a simpler system

Mr. W. E. Jones of Aberystwyth stressed the necessity for keeping accounts which, together with physical data and farm records, enabled one to spot any weaknesses in a farm business, whether simple or intensive. He illustrated this by well-chosen examples, backing up his personal belief that a pig enterprise on a mixed farm is generally suspect. Speaking of the average small farm, he maintained that a farmer is far more likely to achieve a satisfactory livelihood by simplifying the system, specializing in the highest profit enterprise available to him, and then intensifying rather than increasing the number of enterprises, which has usually been the course adopted to combat rising costs. The choice of main enterprises and the right combination of enterprises is of paramount importance in building up a high profit-yielding system. He said that the farming system has more effect on profit than the skills of husbandry, and went on to quote Professor Edgar Thomas: "Under any given set of circumstances the optimum combination is that which will enable the farmer to obtain the maximum financial output for the minimum financial input from his farm as a whole."

The general feeling gained from the Conference is that all in all the future of agriculture is sound so long as the costs of production in the industry as a whole are kept low. We must think before we spend and perhaps train ourselves to do a smaller number of jobs rather better. We should keep details of costs and records so that we can see exactly where we are going and whether we should make any changes, and if so, what. In all this, we must not forget the importance to the industry of good labour—a point stressed by every speaker.

Mr. Hough explained the essence of the Conference when he said: "This country has a mixed farming tradition, and there are few more difficult jobs than to run a really mixed British farm at a high level of intensity. I would suggest that our farms should be no more mixed than our abilities allow."

N.A.A.S. Experimental Husbandry Farms

Liscombe

J. M. WILLCOCK, N.D.A., N.D.D.
Farm Director

ALTHOUGH larger than the average, Liscombe Experimental Husbandry Farm is otherwise typical of many livestock-rearing holdings in the south-west uplands. The farm is within the Exmoor National Park, five miles north of Dulverton, and runs to 495 acres of enclosed land, besides grazing rights on about 1,200 acres of Winsford Hill. The land lies between 850 and 1,250 feet, and practically all that can be cultivated is over 1,000 feet. Three-quarters of the farm faces towards the south.

The soil is composed of Devonian shale and sandstones of moderate depth; the amount of shale varies, and in some instances makes cultivations difficult and causes rather heavy wear on implements. Although most of the land is free draining, springs are common, but they are mainly confined to land adjoining three small streams which run through the farm on their way to the river Barle. The soil in these valleys is alluvium with impeded drainage.

Some fields on the farm need a lot of lime, notwithstanding the result of a soil survey in 1954 which suggests that a considerable amount of lime has been applied to the enclosed land in the past. This is in sharp contrast with the hill land which adjoins the farm on three sides, where the lime requirement varies between 140 and 170 cwt calcium carbonate per acre. The phosphate status, with very few exceptions, is low or very low. Potash is moderately high or high.

The farm was acquired by the Ministry in the autumn of 1954, following what had been a most difficult hay and corn harvest. This, in addition to the fact that there was no labour force on the farm at the time, delayed any buying of livestock until the spring of 1955. There is still much development work to be carried out, and it is anticipated that stock numbers will be increased. At the moment there are a breeding herd of 54 Devon cattle, 120 other cattle, and a flock of Exmoor Horn sheep numbering 310 breeding ewes.

During the first year a considerable amount of renovation work was carried out to the farmhouse and four farm cottages. Since then three new cottages have been built, and plans prepared for new livestock buildings, the existing range being inadequate and unsuitable for the carrying-out of controlled experiments. When these new quarters are available the present buildings will be converted into the office accommodation, small laboratory, tractor and implement sheds and sundry stores needed on a holding on which experimental work is undertaken.

For many years the farm had been badly infested with rabbits, which were the cause of the dilapidated condition of the typical West Country banks

and hedges. Over 3,000 rabbits were caught during the winter of 1954, but this appeared to make little impression on the total numbers. However, following the sweep of myxomatosis during that winter and the following spring, the rabbit problem ceased to exist and, up to the present, no re-infestation has taken place.

Some mention must be made of the red deer which are to be found in considerable numbers on Exmoor and in the surrounding countryside. Although as yet they have not caused much concern, precautions against damage, especially to experimental plots, are being taken by the putting up of electric fences, for which they appear to have a very healthy respect.

Rotations based on grass

As Liscombe is in the centre of a livestock-rearing area having a high rainfall, grassland husbandry forms the basis of the farming system. The rotations are based on the provision of good grass for grazing and conservation, with fodder crops of kales and swedes for the period January–March.

The farm is worked on two rotations. The first (cereals—one-year ley—roots—arable silage—six-year ley) is on the better and more accessible land; the second (roots—twelve-year ley) occupies the less fertile and steeper slopes, and areas not too well served by roads.

The one-year ley mixture is composed of Italian ryegrass/red clover which is seeded under spring cereals, usually after the corn has come through to avoid too much herbage growth at harvest time. The rainfall is in the region of 55–60 inches a year, so there is little risk of seeds failure through drought. The one-year ley is ploughed for roots in May, having provided early grass for two springs, in addition to grazing or material for conservation.

The mixtures used in the six-year ley are varied to allow for greater spread-over of grass production. The basic ingredients of these mixtures include S.24 perennial ryegrass, cocksfoot and timothy/meadow fescue with red and white clovers. Mixtures in the long-ley rotation are usually based on S.23 perennial ryegrass/white clover, with a moderate poundage of S.22 Italian ryegrass to act as a nurse crop.

About 220 acres are in leys and 25 acres devoted to roots—of which a high proportion is kale. Cereals play only a minor part—occupying about 12 acres. The rest of the farm is in permanent pasture and rough grazing, much of which can be improved. To ley farming enthusiasts, the acreage under leys in relation to permanent pasture may appear low, but practically the whole of the breeding herd is out all the year. Much of the permanent pasture is on steep slopes, which provide valuable shelter for outwintered stock.

Silage is most important to the conservation programme, especially for the winter feeding of 9–12-month-old cattle. Practically all of it is made with a cutter-blower machine delivering into trailers, and hauled to silos made either of pre-cast concrete or sleepers. The use of buck-rakes is limited because of narrow lanes, the considerable holiday traffic and the need to have the silos close to where the silage is to be fed.

Nearly half the acreage put up for conservation is made into hay, largely because of the ease of transport during the winter. This can be especially important if weather conditions happen to be severe.

The area is favoured with mild autumns which usually extend well into the early winter, thus providing good conditions for late summer and autumn growth of grass, much of which is used for grazing off as foggage during the winter. The breeding herd usually gets no hand-feeding until after the turn of the year.

Experimental programme: grass and roots

Only a limited amount of experimental work has been undertaken during the initial development period. This has included investigations into the production of autumn grass for winter grazing and the provision of spring keep, carried out in co-operation with the Grassland Research Institute. Considerable attention will be paid to these problems in the future, and every attempt made to find ways of shortening the winter feeding period. As far as possible, evaluation of production and utilization will be made through the animal.

Fodder roots are important in the West Country, and work has been undertaken on kale and swede varieties and the manuring of these crops to provide keep for the midwinter to spring period. The aim is to grow relatively high yields which are frost resistant, to provide fodder for cattle and, more particularly, for sheep during this period. This work is in keeping with the need to provide a rising plane of nutrition at the time it is wanted and yet to allow a larger area of grassland to be rested during the winter.

. . . *polled Devons*

On the livestock side, progress has been made towards breeding a polled strain of Devon cattle. This is a long-term project and involves careful selection. Importance is placed on the need to retain the beef quality of the Devon, as there would be little advantage in breeding for the polled character at the expense of quality. The foundation sires used in this project were Red Galloways, as this breed may make the already hardy Devon hardier still, which would be an advantage in the uplands of the South-West. In our first cross, because the polled character is dominant, all the calves were polled. From this cross a good bull calf was reared for service and his crop of calves out of Devon females were dropped during the spring of 1958. This selection of polled bull calves for use back on Devon females will continue up to the fourth generation. To fix the polled character, a fourth generation polled bull will be used on third generation polled females to give an expected ratio of one pure polled to two impure polled to one pure horned. It will then be necessary to progeny-test the promising polled bulls.

A pilot investigation has been undertaken on methods of weaning and the winter management of spring-born, single-suckled calves. With promising results, we have tried out various wintering treatments, including comparisons between gradual and abrupt weaning, and the possibility of outwintering on grass and kale as compared with the traditional indoor wintering.

. . . *sheep*

Experimental work with sheep is just beginning. This includes a comparison of treatments which aim at reducing the ewes' weight before flushing

and the effect of this weight reduction on prolificacy. Systems of grazing, including forward, sideways and rotational grazing of ewes and lambs, will be carried out under experimental conditions. All ewes and rams are individually marked to enable accurate records of performance to be kept; these will in future provide valuable information for selection purposes.

Experimental Husbandry Farms were chosen by the Ministry so that systems of farming under various soil and climatic conditions could be represented. Liscombe was selected to cover the south-west uplands and although, for obvious reasons, experimental work is still in the development stage, there is little doubt that in the course of time the results of the work should have considerable bearing on many of the problems encountered in these upland livestock-rearing areas.

Visit to Denmark

DENNIS HURST, B.SC.(AGRIC.)
East Riding Institute of Agriculture

Twenty-eight students and staff from the East Riding Institute of Agriculture spent nine days in Denmark last year, studying farming.

THREE-QUARTERS of Denmark's 10½ million acres are devoted to agriculture, and one-tenth to forestry. Since the war, manufactured goods have come to account for 44 per cent of her foreign trade, but it is easy to see how largely she still depends on agricultural exports.

Every square yard of ground which can yield a crop is cultivated. The soils we saw, in a fairly representative picture of Jutland, Funen and Zealand, were sandy, poor and hungry. They are not as fertile as the silts of the Humber basin and the loams of the Vale of York, but nevertheless crop yields are good, no doubt largely because of the much heavier use of artificial fertilizers than is common practice in this country. Most farms have urine settling tanks, and not only have tank spreaders for spraying the undiluted liquid manure on grassland but inter-row attachments for applying it to root crops. What an enormous waste of valuable plant nutrients there is on most British farms!

Barley and sugar and fodder beets are the chief crops we saw growing. Carlsberg II and Herta are the most popular barley varieties. Grass, clover and cereal seed production is important on some farms. Much to our surprise we saw very little grass silage-making, but sugar and fodder beet tops are commonly used.

The average size of Danish farms is little over 40 acres. Light-legged horses are still very common. Farm labour is much more plentiful in Denmark, and workers' unions are effective only on a few really large farms, where a basic minimum wage and hours of working are operative. Most stockmen earn about £7 a week and in addition have a free house, milk and vegetables. They work much longer hours than their British counterparts.

Stock farming

Stock farming is of a very high standard but, although the Danes have been progeny-testing cattle and pigs for some time, I think that they have paid far too much attention to productive economic factors, to the detriment of the constitution of some of their breeds. This is particularly noticeable in the Red Danish cattle: many animals are U-necked, weak backed, high tailed or have misshapen shoulders. Breeders are becoming quite concerned about the liveability of their cattle, and agree that constitutional factors will have to be given more attention in the future selection of stock. The national herd consists of dairy and dual-purpose cattle only; 69 per cent are Red Danish milk cattle, 16 per cent Danish Black and White cattle and 8 per cent Jerseys. The remainder are of other and mixed breeds. Sixty per cent of the cows are now recorded. The Black and White cattle are increasing rapidly, and are a better type of dual-purpose animal than the Red Danes. The Jersey cattle seen were of excellent quality.

About 45 per cent of Danish agriculture's gross income comes from cattle, through butter, cheese, milk and meat and from breeding stock. The overproduction of butter and cheese on the world market has, therefore, severely affected Danish farmers' income in the past year. Milk prices were very low, and milk of 4·5 per cent butter fat from Red Danish milk cattle was bringing only 1*s.* 2½*d.* a gallon in July, and good Jersey milk 1*s.* 4½*d.* per gallon. Low milk prices and the demand for veal and cow beef have led many farmers to sell some of their older milking cows and feed more steer calves to six months of age. These are largely exported to Italy.

We have heard much of Landrace pigs in recent years, but I would not have exchanged our good Large Whites with the Landrace on the dozen or so farms we visited. There are some excellent pigs in the progeny testing stations, but on the ordinary and pig breeding farms the stock are very mixed, and show many symptoms of too close inbreeding. An unusually high proportion of piglets have scrotal hernia and weak legs. We gained the impression that, as with the Red Danish cattle, sows have a rather short productive life and often go off their legs. I am sure that if we can only breed for a slightly finer-shouldered Large White and retain its present sound constitution, prolificacy and mothering abilities, there will be no finer bacon pig in the world.

We were interested to learn that Danish farmers had to pay 7½*d.* a gallon for skim milk, and never fed more than four pints at any stage with barley meal alone. Minerals and vitamins as recommended in this country were added to the barley meal, which if bought cost the Danish farmer much the same as it would here. The gross average return from a bacon pig was approximately £13 15*s.*, and farmers felt very satisfied with it. If the Danes can make a profit at this level we should certainly be able to! Narrow profit margins seem typical of Danish agriculture today; obviously the Danish farmer expects and, what is more, is satisfied with much lower margins than his British counterpart.

We saw only one field of sheep in our 1,200-mile journey through Denmark. There are only 36,000 ewes and lambs in the whole country (less than in the East Riding of Yorkshire), whereas in 1900 there were some half-million breeding sheep. Perhaps it is a pity there are not more sheep now,

with the decline in the profitability of milk products and the rising trend in meat prices.

Folk high schools

Bishop Grundtvig, the founder of the folk high schools, has done much for Danish education. We were deeply impressed with these schools, where young people, usually between 18 and 30 years old, can take a course of study in history, philosophy, literature, economics, politics and physical training. This cultural education, they believe, encourages people to think, and undoubtedly gives them a thirst for knowledge. Many Danish farmers attend courses both at a folk high school and at an agricultural school before taking over a farm of their own. In fact, one-third of all present farmers have attended a farm school, of which there are 30 in Denmark as compared with 36 in England and Wales. The chief difference between Danish farm schools and our farm institutes is that their students are much older, usually between 21 and 24 years, and have 5–6 years of practical experience at least before entering the school, at which the course is entirely theoretical.

Throughout the whole of our short stay we were most impressed with the cleanness and tidiness of countryside and towns. Farm homes are beautifully decorated with flowers and hanging plants, and books are everywhere to be seen. The village community still plays a prominent part in everyday life. Denmark is certainly a country with a very high standard of stock and arable farming, and its homely, generous and kind people will always live in my mind.

★ NEXT MONTH ★

Some articles of outstanding interest

SCIENCE AND THE HILL FARMER *by A. R. Wannop*

THE FUTURE OF BRITISH POTATO FARMING AS I SEE IT *by Sir Thomas Wedderspoon*

BARN HAY DRYING *by C. Culpin*

BROKEN MOUTH IN HILL SHEEP *by A. D. Hitchin and J. Walker-Love*

HARVESTING AND MARKETING CABBAGE LETTUCE *by A. Skelton*

Air Conditions in the Broiler-house

C. G. PAYNE, B.SC.

Royal Veterinary College, University of London

The Royal Veterinary College, with a grant from the Agricultural Research Council, are investigating the possibility of creating and maintaining an ideal environment for the production of broilers. Mr. Payne describes some of their findings.

DURING the last decade a system of intensive husbandry like that developed in the United States has been increasingly used in this country for the production of table poultry. New types of houses have been constructed, and are being used with varying degrees of success.

The differences in the results which have been reported are due to variations in a number of factors, including management, stock, food and housing. The present article outlines data which have been collected to determine whether it is possible to create and maintain an ideal environment for the production of broilers. The factors considered are ventilation, thermal insulation, and relative humidity, and some general observations are made on brooding equipment.

Ventilation

Adequate ventilation is necessary to prevent a build-up of moisture, carbon dioxide, ammonia and other noxious gases, and to keep the temperature of the house between fairly well-defined limits. Little authentic information is available for animal buildings, especially those designed for poultry. Generally it has been suggested that eight air changes an hour are probably adequate for the average poultry-house, but this figure has not taken into account the age of the birds, the density of the population, the height of the building or external temperature conditions.

Natural ventilation depends on such factors as the size of the inlets and outlets, the difference in temperature between the inside and the outside of the house, and the speed of the wind. An open ridge is a very effective outlet, provided it is properly controlled, for example by a continuous "butterfly". It should keep out birds, vermin, rain and snow, and have a maximum outlet area of 5 sq. inches per bird, to cope with summer conditions. Raised chimneys are not particularly effective, as the increase in the height is counterbalanced by the resistance of the surface of the chimney to the rising air, and also by the loss of heat through the chimney. In naturally-ventilated houses the light intensity is always higher than in closed, fan-ventilated houses. Unless debeaking is performed as a routine operation, feather pecking and subsequent down-grading of the birds may occur in houses having high light intensities, especially where crumbs and pellets are fed.

The ventilation rate which field studies in southern England have shown to give the most profitable returns in winter is plotted in Fig. 1. It increases

from about 0·08 cubic feet of air per minute for day-old chicks, to a maximum of 1·50 for fully-grown broilers. Higher ventilation rates may bring the temperature of the house down to 50°F or lower, even when brooders are used as space heaters. These low house temperatures have been accompanied by an increased mortality, mainly due to smothering, and a slight worsening of the food conversion factor.

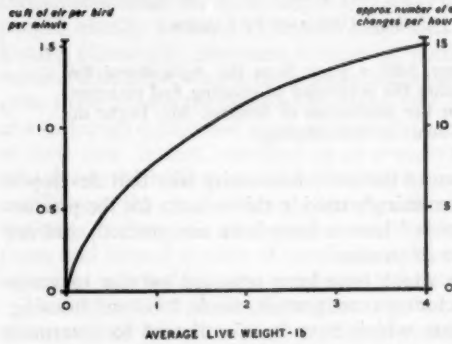

Fig. 1. Ventilation rate for broilers during winter.

Several broiler producers have used ventilation rates as low as one half of those indicated in Fig. 1, in an attempt to keep the temperature above 70°F. But this practice brings the danger that an excessive concentration of ammonia may build up in the house and cause "ammonia blindness" (*keratoconjunctivitis*), particularly in young chicks reared on old litter. The combination of high house temperatures and reduced ventilation has nearly always been associated with poor grading and uneven growth. Conversely a definite improvement may follow quicker air turnover. Thus one farmer, by increasing the ventilation and consequently lowering the average house temperature from 80 to 63°F in winter, reduced his mortality from 5 to 3½ per cent, and increased the number of grade A birds from 40 per cent to 81. A slight improvement in growth rate and food conversion were also noted at the lower temperature.

Increased ventilation rates are desirable in summer, to keep the temperature of the house within reasonable limits on hot days. Fully-grown broilers are not adversely affected by house temperatures of 80–85°F, unless such conditions last for more than three hours. The maximum that four-pound chicken can endure for any length of time without eating less appears to be about 80°F. To maintain rapid growth when the outside shade temperatures are at 72°F for long periods, it is necessary so to increase the ventilation that the house temperature does not exceed 80°F. Considering the heat output of the birds, and the entry of solar heat through the roof, this can be achieved only when the ventilation rates are at least twice those suggested in Fig. 1. A maximum ventilation rate equivalent to at least three cubic feet of air per bird per minute is required.

Draughts

Whilst it is necessary to maintain high ventilation rates, it is also important, particularly in winter, to avoid draughts, which induce overcrowding and a high mortality. For this reason low air speeds are advantageous. At 60°F, the maximum permissible air speeds at ground level, as recorded by the silver Kata thermometer, appear to be twenty-five feet a minute for

day-old birds, and sixty feet a minute for fully-grown broilers. In two houses where the air speeds at floor level during brooding averaged fifty feet a minute, due to large badly-fitting end doors, the mortality for the winter batch averaged 11 per cent. Lining these doors with hardboard reduced the air speed during brooding to a constant figure of twenty feet a minute, and the mortality for the winter batches fell to 5 per cent.

To secure the ideal conditions of a high ventilation rate and a low air speed, the design of the air inlets is all important. The most efficient inlets are controlled hoppers, which open inwards and are preferably baffled on the outside to exclude light and cross ventilation, and gusseted on the inside to prevent cold air spilling over their sides. Ideally they should be sited along all four walls, not less than three feet from the floor and at least nine inches from the eaves to prevent draughts. Where fans are used for extracting air, a maximum area of about two square inches of inlet opening should be allowed for each chick.

In certain buildings some fans have been extended to within two feet of the floor by means of trunking. This has increased the air speeds at chick level by about 50 per cent, and as a result ventilation has been very uneven. Generally, fans extracting a maximum of 4,000 cubic feet a minute are the largest permissible for use in broiler-houses, unless speed controls are fitted to reduce the rate of air flow during brooding. Large fans operating at a low speed are much quieter than small fans of similar capacity, working at higher speeds.

Insulation

Insulation of broiler-houses is desirable to minimize the loss of heat during winter, to keep out solar heat in summer, and prevent condensation. Table 1 shows the improvement effected by increased insulation on the temperature and humidity in broiler-houses during winter.

Table 1

Effect of insulation on house micro-climate

(Incoming air 35°F, 100 per cent relative humidity, ventilation rate as shown in Fig. 1)

Weight of birds	Sensible heat	Water production	Resulting house temperature when "U" value		Resulting house humidity when "U" value	
			0·50	0·20	0·50	0·20
lb	*B.T.Us h/bird*	*oz/bird/day**	*degrees F*		*per cent*	
2	30	6	54	58	93	79
3	38	8	56	59	82	75
4	44	10	57	60	80	73

"U" value—
0·50 corresponds to asbestos roof lined with hardboard.
0·20 corresponds to asbestos roof lined with hardboard and 1-inch fibre-glass felt.
* Including evaporation from drinkers, and splashings.

The addition of one inch of fibre-glass to a hardboard-lined asbestos building raised the temperature of the house by about 4°F and reduced the humidity by about 8 per cent. These differences, even though they are relatively small, are most important, particularly during winter when slight

increases in temperature, with an associated decrease in relative humidity, will reduce the expense of using brooders as space heaters and yet maintain adequate environmental and litter conditions. For broiler-houses, the average "U" value should not be greater than 0·20.

Relative humidity

Although there have been no critical experiments, it is generally agreed that relative humidities of 60–80 per cent are ideal for poultry. Table 1 shows that humidities of this order are possible in broiler-houses during cold weather only if the insulation of the building is sufficient to give a "U" value around 0·20 or less.

Studies in southern England have not shown that variable humidities in broiler-houses have any direct harmful effect. Nevertheless, when the litter is unduly wet, excessive ventilation in winter is usually associated with a high relative humidity in the house, which will lead to deterioration of the litter. This in turn may lead to a high mortality, as is shown in Table 2.

Table 2

Litter and housing conditions and mortality in broilers during winter

Litter type	Number of birds started	Average house relative humidity	Average house temperature	Difference house temperature from outside	Mortality To 2 weeks	Mortality Total
		per cent	*degrees F*		*per cent*	
Dry, needs occasional turning	20,000 (5 houses)	70	62	20	1	2½
Wet, top requires replacing frequently	30,000 (7 houses)	78	57	15	5	12

If the temperature of saturated air is raised by approximately 7·5°F, its relative humidity falls to 75 per cent; if the increase in the temperature is about 17°F the relative humidity falls to 50 per cent. When the air in an intensive poultry-house has a relative humidity of 75 per cent or more, moisture is removed so slowly that the water content of the litter tends to rise, and the conditions become unfavourable. It is essential to maintain a temperature of 60°F during winter, to keep the litter dry.

Vapour seal

In designing broiler-houses it is desirable to stop hot humid air entering the insulation, to prevent condensation and maintain the full effect of the insulation. There are many suitable proprietary brands of aluminium foil, roofing felt and other water-repellent substances, which should form a complete layer along the inside of the roof beneath the main insulating material.

To improve hygienic conditions in poultry-houses, increasing use is being made of concrete floors. They are not without disadvantages in damp situations, and to keep out moisture they should be vapour sealed. The importance

of this may be illustrated by reference to two similar houses on one farm, where the management has been identical and where the water-table is within fifteen inches of the concrete floors. In one house the floor was vapour sealed. Temperature and humidity readings taken for a continuous period showed that in the house with the unsealed floor, the relative humidity was constantly 8–10 per cent higher, even though the temperatures were the same. In consequence bad litter conditions prevailed at all seasons of the year, and could only be counteracted either by keeping the brooders full on throughout the crop, or by changing the litter weekly. It was found that the conditions in this house were improved by putting two inches of concrete on tarred felt on top of the original floor.

Brooding equipment

The effect of brooders on both the temperature of house and on humidity is shown in Figs. 2 and 3. Normally, in winter a maximum output of about 12 B.T.Us an hour is required per day-old chick, to maintain ideal conditions under the brooder and keep the temperature of the house above 60°F. By the fourth week, the brooders will be producing on average about 5 B.T.Us an hour per chick. In very cold weather a maximum output of 15 B.T.Us per bird per hour for space heating is necessary, to ensure adequate ventilation and keep the house temperature above 55°F. If the ventilation rate is not kept up, high ammonia concentrations may result, with the possibility also of severe outbreaks of disease and cannibalism. If a normal ventilation rate is maintained and the house temperature is allowed to fall below 55°F, the birds may crowd, causing considerable loss from suffocation. This overcrowding will be accentuated by the deterioration of the litter which will result, and the food conversion will not be efficient.

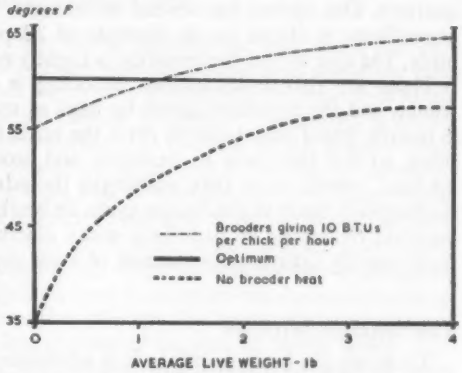

Fig. 2. Temperature in well-insulated house. Outside 35°F. ventilation—see Fig. 1.

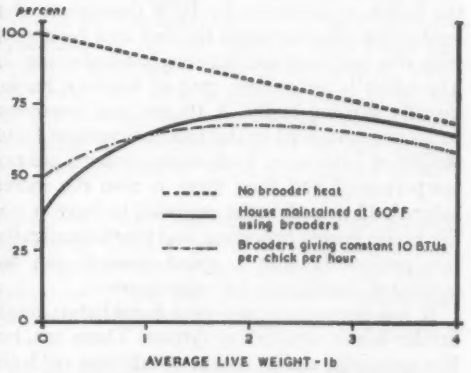

Fig. 3. Humidity in same house. Outside 100 per cent at 35°F.

For ease of management and maximum efficiency, most brooders heat

chicks from above. The canopies are often raised as the chicks grow, to heat as wide an area as is economically possible. To direct the heat on to the young chicks, and keep the litter dry when the brooder is used as a space heater, the canopy should be designed to reflect heat downwards. It should also be well insulated (double-skinned with insulating material and air space), to prevent a high proportion of the heat output flowing directly through the extractor ventilators.

Separate brooding-houses are being used on a limited scale. Usually one small brooding-house is sited at the end of a broiler-house. The chicks are reared in it for four weeks, then chased through tunnels to the finishing quarters. This system has several advantages. With little increase in capital expenditure it allows for an increase of 30 per cent in the throughput of birds. The cost of fuel for brooding is slightly reduced.

There are also disadvantages. Brooding is ended suddenly, even during winter, and the brooders cannot be used as space heaters after brooding. It is usually found impossible to drive the birds from one house section to the other, so that they have to be crated and carried. Thus they suffer a slight set-back, which more than outweighs the advantages. In addition there is no complete break in the disease cycle. In broiler plants in southern England, endemic outbreaks of baccillary white diarrhoea and respiratory diseases have usually caused abandonment of such production policies.

Thermostat settings

To secure the best conditions it is advisable to set thermostats at 60–65°F in winter, and about 68–70°F in summer. Higher temperatures are associated with either a reduced ventilation rate, which has several disadvantages already stated, or with dearer space heating during the winter. To increase the house temperature by 10°F throughout the batch without reducing the ventilation rate increases the fuel cost by approximately 6*d*. a bird. Coupled with this temperature increase is a reduction in the house relative humidity. The effect is an uneven crop of broilers, having poor feathering and consequently grading badly. A 10 per cent improvement in grading is equivalent to an improvement in the food conversion factor of 4 per cent, or in the live weight of 3 per cent. Such improvements are rarely noted at the higher house temperature; and then there is also the increased cost of fuel to be considered. If it is thought essential to have a continuous flow of air through the house during brooding, and thermostatically-controlled fans are used, one fan, preferably with a speed control, can work continuously at half the estimated ventilation rate requirement.

It has been suggested that humidistats might form an integral part of a broiler-house ventilation system. There are, however, certain disadvantages. For example, under winter conditions cold air usually enters the house at nearly 100 per cent relative humidity: if the humidistats were set at 80 per cent relative humidity and the temperature of the house was below the thermostat setting, they would probably keep the fans going continuously. Consequently the temperature of the house would fall, the humidity rise, litter conditions deteriorate, and the birds would crowd and smother.

Farming Cameo: Series 2

12. South Denbighshire

D. J. THOMAS
District Advisory Officer

SOUTH DENBIGHSHIRE is not a well-defined geographical area, but is that part of the county lying to the south of the high Horseshoe Pass above the little town of Llangollen, now famous for its annual international festival of music and folk dancing. Apart from the Vale of Llangollen, the district is known locally as the Ceiriog area, and is bordered to the west by the Berwyn range of mountains, to the south by Montgomeryshire and to the east by the plains of Shropshire. Crossing the area from west to east, are the rivers Dee, Ceiriog and Tanat, with parallel ridges of hill land rising to 1,200 feet above sea level.

Border Wonderland, the title of the Ceiriog valley official guide, aptly sums up the scenic beauty of the district, which attracts thousands of visitors each year. The London to Holyhead road (A.5) skirts the eastern boundary, and it is from this road that travellers through the long turbulent history of the district have caught their first glimpse of the hills of North Wales.

Historians, sociologists and in particular ethnologists, as well as other specialists, find this part of Wales a rich field of study, containing as it does two distinct types of people, religious customs, language and culture. Oswestry, a small town with an important market, though in Shropshire three miles over the border, is the focal point of the farming community. Its importance to South Denbighshire is emphasized by the fact that all main roads run from west to east along the valleys and hence towards Shropshire. More Welsh is heard in Oswestry on market day than in many a town in Wales. Around the border only about half the farmers speak Welsh, but a dozen or so miles to the west, the language is spoken by almost all the farming community. This interesting flow and interflow of Welsh and English attracts a great many students.

Geologically, the area is almost completely Ordovician, with some Silurian rocks around Llangollen in the north. Glacial activity is well defined and geological phenomena such as synclines, faults, etc., abound. The soil is mainly a thin shale and generally low in lime and phosphate. A small area of Carboniferous Limestone is found in the vale of Llangollen and forms a majestic escarpment.

Rainfall varies from 30 to 45 inches and is conducive to the growth of grass, the predominant crop. Swards are mainly based on the Cockle Park types, with cocksfoot largely used on the shallow "sideland" farms and perennial ryegrass on the better land; the white clovers are grown on both types of land. Regular applications of basic slag are required to prevent the intrusion of bent and Yorkshire fog. Scenic beauty and panoramic views delight the visitor but mean difficult farming conditions. Cash crops are practically non-existent except on a few of the bigger farms; cereal acreage

is low and grown only for fodder. The farms are usually small; out of less than 600 holdings, 220 are below 20 acres, 240 between 20 and 100 acres and only 100 farms exceed 100 acres. All figures exclude rough grazing. Dairying produces the major farm income; over 70 per cent of the farms sell milk and there are only a handful of what could be termed genuine hill farms situated on the foothills of the Berwyns. Many farms have hill and rough grazings attached, giving a farming system of dairying and fat-lamb production. Dairy cows occupy the lower land with the sheep, utilizing the "ffridd" or in-bye land, and also spend anything up to eight months on the hill proper. The milk churn is found even at farms over 1,000 feet. Welsh Black cattle are few and the Friesian easily the most popular, followed by Shorthorn and Ayrshire. The great demand for Friesian stock of all ages in Oswestry and local markets considerably influences the choice of breed.

The sheep breeding flock is mostly the hardy Welsh Mountain, mainly bred pure on the hill farms, but otherwise crossed with the Suffolk. Border Leicester rams are also popular, especially for producing the latest export, the Welsh Half-bred. The Welsh Half-bred Sheep Breeders' Association hold one of their two annual sales at Llangollen, and last year over 9,000 sheep were sold. The farms are less profitable than in neighbouring Shropshire because of the less fertile soil and expensive cultivations: and the sloping land of shallow, stony soils, with boulders and even solid rock, damages machinery and reduces safe working speeds. The use of machinery is hindered by physical conditions, lack of capital and, most important, by size of farm. It is quite uneconomical for the majority of small farms to purchase the machinery necessary to deal with a wide range, though small acreage, of crops. No progress has been made with co-operative ownership of machinery, and the bulk of the cultivations during and since the war were carried out by the Agricultural Executive Committee machinery service.

In spite of these difficulties great progress is continually being made. The adoption of the small tractor, with its built-in implement system, has revolutionized the area, and is found on almost every farm. Not only does the tractor do the cultivations, but all manner of work from log sawing to carrying the milk churns to the main road. Although dairying extends to the hills, the number of stock reared and the low amount of milk sold has enabled many farmers to take full advantage of the Hill Farming and Livestock Rearing grants. The traditional Welsh buildings of stone and slate are generally very inconvenient and insufficient for modern needs. Considerable improvement, reconstruction and new building goes on under the Farm Improvement Scheme. Pigs are of minor importance but poultry production is on the increase.

The policy of the district is likely to remain as it is, based on milk and sheep, with perhaps a slight increase in store cattle especially for beef production. It is hoped that more specialization will take place; one example being the reduction of a multiplicity of enterprises on some small farms and an increase in the number of dairy cows against the number of young stock reared.

South Denbighshire will however remain a truly border district, and its farming will continue to be a Welsh way of life, rather than a strict business enterprise. Nevertheless new techniques and methods are slowly but surely gaining ground amongst these sturdy, resilient and independent people.

At the Farmers' Club

Feeding Standards for Livestock

"Food intake determines productivity, not the reverse." The scientific background to this new and revolutionary approach to livestock rationing was explained and discussed with admirable clarity by Dr. K. L. Blaxter, of the Hannah Dairy Research Institute, at the Farmers' Club meeting on 11th February. In a critical examination of our present feeding standards, based on energy intake expressed in starch equivalent units (S.E.), he revealed the system's merits and shortcomings.

There have been exciting and spectacular advances in our knowledge of the dietary factors in animal nutrition (amino acids, vitamins, trace elements) during the past fifty years. But Dr. Blaxter stressed that it is the energy intake of the animal that determines, directly or indirectly, its requirements of all other essential nutrients. Shortage of specific nutrients can affect production by grossly interfering with the normal processes of energy utilization, and one of the ways this is manifested is in failure of appetite—voluntary reduction of energy intake. "This," he said, "perhaps emphasizes still more the very central importance of the energy intake in any consideration of animal needs for food nutrients."

The S.E. method of calculating energy requirements for animals was first worked out for fattening steers. Within certain limitations, for this purpose it is perfectly sound in principle. If properly and intelligently used, the standards enable the farmer to design a profitable ration under any prevailing economic circumstances. No ideal rate of gain is predicted, no "normal standards" of rate of gain are set up, and no recommended allowance of food per day is given. But the tables provide basic information on the food intake/body gain relationship, allow for the effects of diminishing returns, and also, indirectly, for the increased expense of feeding a more concentrated ration to achieve high rates of gain.

Their practical value is, however, limited by the precision with which gain can be predicted from food intake. An individual steer may differ from the average in its requirements for a particular gain, or the nutritive value of the feeds used may have been under- or over-estimated. Thus discrepancies can arise from inaccuracies in judging animal needs and food values.

Analysis of feeding trials by Dr. Dodsworth at Aberdeen has shown that actual performance can easily differ as much as 100–200 per cent from that predicted, the corresponding error in S.E. intake being about 10 per cent—1–2 lb S.E. per day. "This inaccuracy in rationing has long been recognized," said Dr. Blaxter. "*Rations for Livestock* states: 'It frequently happens that rations worked out on the above system fail to give the desired result' and adds 'the watchful eye of the feeder must decide in individual instances what adjustments should be made to ensure that the exact requirements are being supplied.'" The importance of Dr. Dodsworth's work is that it provides, for the first time, a figure indicating the extent of these adjustments, which our

feeding manuals necessarily leave to the stockman's art. Dr. Blaxter added: "There is no reason whatever to believe that the precision of rationing is any greater in other classes of stock."

Experiments to determine maintenance energy requirements more precisely show a ±6–8 per cent variation on the mean for fattening steers, and a ±14 per cent variation for dairy cows. These are biological in origin and not experimental errors. Similar variations occur in production requirements. About one-third of the total discrepancy between expected and actual performance on a calculated ration is attributable to variation between individual animals in their food energy requirements.

In the extension of the S.E. system to the dairy cow, the potential economic value of rationing methods has been lost, since no information is given on the way and extent to which the food intake determines milk output. Such knowledge is essential if rations are to be planned for the most profitable production level.

Input/output experiments and short-term feeding trials designed to remedy this situation show that milk yield is quite sensitive to changes in energy intake, and that the law of diminishing returns applies. Up to a point, milk yield and body weight rise as food intake goes up; further input raises body weight more than milk production. Unfortunately, interpretation of the *average* results of these experiments has led to some obviously erroneous conclusions.

Work at the Hannah Dairy Research Institute indicates that the response of cows to both over- and under-feeding depends on their productivity. High yielders are more responsive than low yielders to increases in S.E. intake above standard. Further increases in S.E., however, result in progressively smaller increments of milk.

Thus when food is expensive it would be better to economize on the low yielders than on the high ones, rather than to reduce rations all round. The same applies to periods of high and low milk yields during individual lactations. On this basis, where the milk price/food price difference is known, rations can be planned for maximum profit. The scheme is now being tested on a number of farms.

Most of the S.E. figures used in formulating rations are derived from digestibility experiments and chemical analysis made before the 1914–18 war. More recent work in Norway and Scotland indicates that these listed values are subject to a 10–15 per cent error. In practice, the difficulty of assessing the feeding value of most farm-produced bulky foods far outweighs any errors arising from variations in animal requirements or from the accuracy of the few basic experiments made on feeding value. The same problem exists with concentrated food and roots.

"It would appear," concluded Dr. Blaxter, "that the task of making our ration standards a more decisive and useful tool on the feeding of our stock is going to be a difficult one. But at least we are beginning to realize that present methods of rationing have their limitations, and that is perhaps half the battle."

Sylvia Laverton

In Brief

CHANGE OF PERMANENT SECRETARY TO THE MINISTRY OF AGRICULTURE

The Permanent Secretary, Sir Alan Hitchman, K.C.B., will leave the Ministry on 1st April to take up an appointment as a member of the United Kingdom Atomic Energy Authority. He will be succeeded as Permanent Secretary by Mr. A. J. D. Winnifrith, C.B., who is at present Third Secretary in H.M. Treasury.

POTATO STORAGE

In the opinion of Mr. C. V. Dadd, N.A.A.S. Eastern region crop husbandry officer, clamps are probably good enough for the *temporary* storage of potatoes —say up to December—and for small tonnages, but otherwise bulk storage is the thing. Look at the advantages: greater output of riddling per man day, due to longer working hours; better working conditions; no time wasted opening and closing clamps, independence of weather conditions, and losses from disease are generally less. Bulk storage in buildings also provides the opportunity for long-term storage (up to May and June) without sprouting if the new Nonanol technique is used (see the September 1958 issue of this JOURNAL).

True, this calls for more capital investment, and transport costs for bringing the potatoes to the store have to be met.

Too much loose soil in the heap should be avoided, especially soil coming below the elevator. Air, failing to pass through very dirty potatoes, tends to pass around soil cones, and lack of ventilation causes higher temperatures and premature sprouting as well as improper drying. Heaps more than 6 feet deep need some form of bottom as well as ample top ventilation. Forced draught by fan is a good insurance against the kind of difficult conditions we had last year; it need not cost a great deal.

A good layer of loose straw (about 18 inches) should cover the potato heap. This acts as a sponge to the rising moisture, and it prevents greening; it also stops surface freezing in hard weather. High or even medium density bales are seldom satisfactory.

LOW COST MEAT FROM GRASS

Professor McG. Cooper, speaking at the I.C.I. Conference at Malton, Yorkshire, on 5th February emphasized the word *cheaper*, rather than *cheap*, production of meat, since meat, he said, can never be a cheap commodity; it is a too wasteful and inefficient way of turning fodder crops into human food. Only a prosperous or relatively prosperous community can afford to eat meat in quantity.

The mixed stocking of pastures does not give a higher output than single stocking if the pasture growth is being adequately consumed, as shown by Ruakura and other experiments. Moreover, there is the necessity in the north of England of combating nematodirus by freeing certain fields of ewes and lambs for one year. During this year the selected fields can be grazed with cattle only or mown for silage.

Forward creep grazing with ewes and lambs gives three distinct advantages over "set" stocking: (1) As Woodman's classic experiments have shown, rest periods followed by quick defoliation give a higher output of grass than continuous defoliation; (2) because of the higher output, more liberal fertilizer applications are economically sound, and (3) the lambs have preferential use of the grass as soon as they start to graze. The ewe is therefore not a competitor for the best of the grazing. She cleans up the grass that the lambs leave and with it the greater part of the worm burden. Therefore at each round of the paddocks the lamb is presented with a clean fresh growth of high feeding value.

A questioner asked if there were *any* snags. He was assured that with 7 or 8 ewes plus lambs per acre, none had been encountered. Provided a clean field was used each year, none was expected.

Excessive imports are unlikely to glut the market, but in Professor Cooper's opinion there is some danger of too many home-produced lambs coming on the market in August and September. Good husbandry can ensure that a higher proportion of lambs are fit in June and July.

Replying to another questioner on the subject of white versus red meat, Professor Cooper said he would not care to predict the outcome if the broiler became a serious competitor with red meat, but he regarded the broiler as more of a luxury and therefore more likely to suffer from an all-round drop in prices due to over-production. After all, he said, there isn't much actual meat on a 3 lb broiler.

RETURNING RABBITS

Lord Waldegrave commended the pioneer spirit of rabbit clearance societies at a meeting in London on 5th February. They have, he said, been quick off the mark, and they now number a hundred (83 in England and 17 in Wales) covering between them over 1¼ million acres; another hundred societies are in process of being formed. He stressed the importance of all farmers and landowners taking collective action *at once*. Foxes, stoats, weasels and other allies of the farmers certainly help to keep rabbits in check, but, as Lord Waldegrave said, "We can't win a campaign with allies alone".

It should not be thought for one moment that myxomatosis is in itself sufficient to control rabbits. As time goes on, more and more rabbits will recover from the disease; and they may even build up a resistance to it. In South America, where the disease started, it is widespread among rabbits, but it is now only a mild form and does not kill them. In Australia, where myxomatosis at first killed over 99 per cent of infected rabbits, less virulent strains have already appeared in parts of the country.

Rabbits are no respecters of farm boundaries, and the best way to tackle them is through the rabbit clearance society movement. Contributions to rabbit clearance societies are in the nature of an insurance against future losses from rabbits. And since the Ministry makes a pound for pound contribution to the cost, the premium is half price.

It was decided at this meeting that the rabbit clearance societies should form themselves into a National Federation.

CEREALS ON CHALK

Dr. G. W. Cooke of Rothamsted, discussing the manuring of cereals at a recent conference at Salisbury, said that the agricultural revolution which has taken place in Britain in the last twenty years has been at least as marked in southern England as in any other part of the country. In Wiltshire, Hampshire and Dorset the acreage under cereals has increased appreciably. Changes in cropping prac-

tices have been successfully consolidated by increased mechanization, improved varieties of cereals, new weed-killers and the increased use of fertilizers. The country as a whole uses five times as much nitrogen and potash and twice as much phosphate as before the war. The extra use of fertilizers has been necessary to raise the fertility of our soils so that full crops can be grown on a permanent basis.

Maximum benefit from nitrogen fertilizers depends on using the modern stiff-strawed varieties of cereals. These give high yields only if they are well fertilized. In field trials new varieties like Hybrid 46 and Cappelle give an extra 4½-5 cwt of grain from a standard dose of 28 lb of nitrogen per acre, but the older varieties give only an extra 3 cwt/acre of grain. This means that modern winter wheats justify a heavier nitrogen dressing which, in the trials quoted, gave a profit of about 180*s.* per acre, while the older varieties (which gave smaller responses and justified less fertilizer) gave a profit of only 100*s.* per acre. Modern barleys gave a profit from nitrogen manuring of 207*s.* an acre, while Spratt and Plumage Archer gave only 97*s.*

The profit from nitrogen used on cereals increases sharply with increasing dressings and reaches its maximum value for modern varieties of wheat and barley with dressings in the region of 4-5 cwt per acre sulphate of ammonia. Dr. Cooke recommended that growers of stiff-strawed varieties of wheat and barley in the Salisbury area should use about 70 units of nitrogen on these crops (equivalent to about 3½ cwt per acre sulphate of ammonia). Surveys of fertilizer practice show that farmers in Wiltshire and surrounding counties should on average, double the current rate of nitrogen dressing used on spring barley and increase that given to winter wheat by 50 per cent. These increases are completely justified on economic grounds. Fertilizers used correctly reduce costs of production. Dr. Cooke quoted an example to show that whereas barley grown without nitrogen might cost 20*s.* per acre to produce, barley which had received 2½ cwt/acre sulphate of ammonia not only gave nearly twice as much grain per acre but also the cost of producing each hundredweight of grain was reduced to 14*s.*

Mr. E. G. Thompson, of the N.I.A.B., said that in some areas Cappelle winter wheat now occupied 75 per cent of the acreage, though there could be dangers in such a predominance of one variety. Jufy I spring wheat was described as an even higher yielder than Koga II, with stiff straw but only moderate grain quality. Proctor barley was unchallenged, except by Herta and Rika, for feeding grain only. Least progress in breeding for stiff straw had been made with oats.

Mr. H. T. Horsman, N.A.A.S. Machinery Officer, South-West Region, dealing with the costs of combining, drying and storage, was in favour of the bagger combine for even the smallest acreage and the batch drier for labour economy. He mentioned a 200 acre one-man Cotswold farm with three items of field harvest equipment—tanker combine, 6-ton lorry and bicycle—plus a batch drier. A continuous drier requires a throughput of 30–40 cwt an hour to justify the operator's wages.

Mr. Horsman also described 3-furrow ploughing at 15–18 acres a day in America, using long-tapered mouldboards and speeds of 6 m.p.h. Bulk handling of fertilizers is also common.

Replying to a question on American practice, he said they would never dream of having a man riding on the back of a corn drill.

On the subject of rotations to avoid diseases, Mr. J. F. H. Cronshey of Plant Protection Ltd. concluded that it was only the complete absence of a rotation that generally brought disaster, but it was a question of keeping reasonable soil health and avoiding the need for drastic remedies. He suggested the need for a non-cereal type crop in the ordinary ley/cereal rotation.

THE MINISTRY'S PUBLICATIONS

Since the list printed in the December 1958 issue of AGRICULTURE (p. 481), the undermentioned publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.

BULLETINS

No. 49. Intensive Apple Culture (*Reissue November 1958*) 4*s.* (4*s.* 4*d.* by post)

No. 95. Strawberries (*Revised February 1959*) 4*s.* 6*d.* (4*s.* 11*d.* by post)

No. 112. Commercial Production of Pot Plants (*Reissue January 1959*) 5*s.* 6*d.* (5*s.* 11*d.* by post)

No. 133. Apples and Pears (*Revised October 1958*) 7*s.* (7*s.* 8*d.* by post)

No. 152. Methods of Intensive Poultry Management (*Revised January 1959*) 3*s.* 6*d.* (3*s.* 11*d.* by post)

Technical Bulletin No. 8. Biological Methods for the Evaluation of Insecticides (*New November 1958*) 3*s.* (3*s.* 4*d.* by post)

OTHER PUBLICATIONS

Experimental Horticulture No. 2 (*New January 1959*) 3*s.* 6*d.* (3*s.* 10*d.* by post)

How to Get the Best out of Farm Machinery (*New December 1958*) 9*d.* (11*d.* by post)

Smallholdings Organised on the Basis of Centralised Services: Land Settlement Association Report and Accounts 1957–58 (*New January 1959*) 2*s.* 6*d.* (2*s.* 9*d.* by post)

Co-operative Farms and Smallholdings with Centralised Services in Wales. Welsh Land Settlement Society Reports and Accounts 1957–58 (*New February 1959*) 2*s.* 6*d.* (2*s.* 8*d.* by post)

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3*d. each* (5*d. by post*).

ADVISORY LEAFLET

No. 466. Artificial Lighting of Laying Hens (*New January 1959*)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

BOOKLET

At the Farmer's Service (*Revised November 1958*)

GROWMORE LEAFLET

No. 106. Potatoes in Allotments and Gardens (*Revised December 1958*)

The Ministry's Publications will appear every month from April onwards, and will include short notes on publications of particular interest.

NOTE. From April onwards, a list of the Ministry's new and revised publications will appear every month.

Book Reviews

The Hills of Alentejo. HULDINE V. BEAMISH. Geoffrey Bles. 21*s*.

A land of cork-oak forests and sweet chestnut groves; of wild black bulls and communally-managed hordes of free-ranging pigs; of bustards, bee-eaters, charcoal-burners and ruined Roman cities. A landscape sufficiently exotic to appeal to the wanderer in most of us, especially when we realize that it bathes in the glow of the reliable southern sun, Alentejo is the southernmost but one of the provinces of Portugal, ranging over the plains and mountains that lie south and east of Lisbon. And here Huldine Beamish has her farm—though whether it is her own farm or whether she is living with the farming family is not clear. But there she has settled, a deliberate "refugee" from what she calls the "sterilized and socialistic" countries of the North (she has tried England and Sweden). She has been there long enough to become on intimate terms with the countryside. Of the people, customs and farming methods, she writes with inside knowledge. Her own farming knowledge is obviously considerable, and those of us who like reading of other people's farming find in this book an authentic picture of Portuguese agriculture.

But is it all exotic? As I progressed I found my mood becoming more and more nostalgic. This was not so much Portugal as the English countryside I knew as a boy. The pig-killing: Miss Beamish describes the singeing, the scraping of the hide after a thorough scrubbing with cold water, the catching of the blood, the method of cutting up the carcass. It is all exactly as my father used to do it.

And the bread-oven. "The oven is heated by lighting huge bundles of brushwood covering the extensive floor. When it is hot enough, and the dough has risen properly, the brushwood ashes are swept out, except for a few left by the oven door, and the loaves put in with a long-handled wooden shovel." Yes, my grandmother made bread just like that. We still have the old oven behind the fire-place.

Portugal is evidently where rural England was before the first world war, for though mechanical marvels have indeed appeared in the villages, they have made little alteration so far to the old way of life. And so, in this cameo of a farm a thousand miles below our south-western horizon, we ponder over echoes and reflections of an English countryside that has gone for ever.

R.W.

British Weather in Maps. JAMES A. TAYLOR and R. A. YATES. Macmillan. 21*s*.

The first impression gained on handling this book is an excellent one. The cover is in admirable taste, the printing first class and the profusion of fascinating diagrams offer great promise of a worthwhile addition to helpful books on meteorology. Nor are first impressions contradicted by a closer inspection.

There has long been far too pronounced a gap between the meteorologists with a mathematics or physical science discipline and those who have approached the subject with the aid of a geographical training. There might even be suspicions that there are some attempts made to maintain such a division by interested parties on both sides of the mental ravine. Here, however, is a gallant attempt to bridge the gap. It deserves to succeed, for an immense amount of care has gone into the compiling of the book, both in the text and in the all-important illustrations.

After a description in simple terms of the basic meteorological theory, the authors have set out to explain the details available in the official Daily Weather Report, both in the style of the meteorological analyst whose prime duty it is to forecast the future weather, and also, in a more human manner of weather interpretation. In other words, the reasons for the weather are stated along with its results in a series of typical meteorological samples.

There may be meteorologists who wish to cavil at some of the statements in the book, for meteorology is a complex and

endlessly controversial subject, but so much has been successfully accomplished that it would serve no useful purpose to encourage academic quibbles.

For geography students at home, at school or at a university, it is clearly essential reading, for it is in a class of its own, and many meteorologists would profit from its perusal. For farmers it is more of a luxury, but anyone who is interested in the general side of meteorology will find it well worth a guinea.

L.P.S.

The Fabric of Farming. A. N. DUCKHAM. Chatto and Windus. 15*s*.

In his new book, Professor Duckham traces the growth of farming from its early simplicity to modern complexity. He starts from both the historical and bio-geographical points of view, and gives the latter much more emphasis, which is a new departure for works of this type. Finally, he describes how the principles of farm management which emerge from this study are tested out, using Reading University Farm as an example.

The development of the farming industry is covered very adequately and the colourful title is supported by equally attractive chapter headings—the whole a fascinating pattern and an absorbing study of this very complex industry. The style is vigorous and colourful.

The author indicates that he has three types of reader in mind—first year students of agriculture and allied subjects, teachers of rural science, and the non-farming public. His book should be read by all these people, particularly teachers of rural science. I thought the chapter enumerating the seven rules of farming conduct especially valuable.

This should be a fascinating book, compelling one to read avidly from cover to cover. I found it, however, extremely difficult to read a number of the chapters easily, and the sheer enjoyment of reading an entrancing book was marred because the text was spattered with numerals referring to foot-notes, other pages, chapters or illustrations and by the very prodigal use of parenthetic brackets. In my view all this is quite unnecessary and very unfortunate. The references could well be incorporated in the text and any advice on further reading relegated to the end of the book, as in fact it is in a valuable appendix. Professor Duckham is of such stature in the world of agriculture that his readers will accept his word without the added emphasis of profuse reference to the views of others.

I would presume to make one other suggestion. Whilst the book gives an excellent picture of the warp and woof, the value of the finished product is left to the imagination of the reader. I would like to have seen a final chapter which gave the place of farming in the industry of the nation. What does it mean to the country in economic terms? How much of our food is produced from our own soil? I feel this is essential information for inclusion in a book of this type, especially for the non-agriculturist who, as the writer indicates, needs to know something of the practice, basis and value of modern farming.

Here is a book which I forecast will take its place as one of the basic text-books in agriculture. Professor Duckham has performed a valuable task in bringing a vast amount of material under one cover and directing our thoughts from the purely historical to the bio-geographical development of farming. It is well illustrated by photographs and diagrams, and at 15*s*. is excellent value. The acid test of any text-book is—does one approve? I have already recommended it wholeheartedly to my own students!

H.I.M.

The Black Fens. A. K. ASTBURY. Golden Head Press. 42*s*.

To the casual passer-by, the Fenlands surrounding the Wash are often flat and uninteresting, an area in which intensive agriculture is fervently pursued in hedgeless desolation. Mr. Astbury has shown in his book that what the Fens lack in scenic interest is more than compensated for by the fascinating history of their evolution and the surprising problems with which the inhabitants are continuously faced.

The book tells of the physical characteristics of the peat fens, the way in which this black vegetable soil was formed and how it is daily wasting away, so resulting in a lowering of land levels. It describes the effects of this loss of land on the lives and work of the inhabitants—the farmer,

the builder, the road and railway engineers. Above all, prominence is given to the problems facing the civil engineers responsible for land drainage. Clearly, had not the problems of flood protection and drainage been tackled, the 1,300 square miles of fenland would still be mainly derelict marsh, as was the case three hundred years ago.

Any stranger to the Fens who has a practical turn of mind will read the first half of this book with increasing interest, but may falter on the second half without a sound detailed geographical knowledge of the area. To anyone with this qualification, the discussions on waterways and road systems past and present will be of particular interest, and for various local purposes the book, which is indexed, could be a useful work of reference.

Perhaps the most revealing features are the large gaps in the recorded physical history of the area and, therefore, the wide scope which exists for surmise and speculation on its development from the ice-age, through Roman and Norman times to the seventeenth century and the present day. The historical and physical evidence gleaned from the site and from aerial photographs are pieced together in a manner similar to that used in crime detection, and from this evidence a more than plausible story is built up.

The author has written in simple terms with journalistic skill not as an expert, as he himself admits, but as a diligent recorder of the knowledge, experience and opinions of others who are experts in their respective fields. In addition, he has analysed the material so obtained and has presented his own opinions and drawn his own conclusions. Some of those which are open to criticism have been modified or reversed by afterthoughts recorded in an appendix.

The book is enhanced by sixty aerial and other photographs, maps and sketches.

J.C.W.

The Theory of Evolution. (Pelican Biology Series.) J. M. SMITH. Penguin Books. 3*s.* 6*d.*

Publication of the *Origin of Species* (1859) and the *Descent of Man* (1871)—with their crucial implications for religion and philosophy—not only staggered the Victorians, but started half a century of vehement controversy. No fewer than 7,500 copies of the first book were sold in seven years. Even today there are many who regard the *Theory of Evolution* as "just another theory"; but as Dr. Gavin de Beer recently wrote, "The fact of evolution is now universally accepted by all competent to express an opinion, and its mechanism has been, in principle, explained".

The Linnaean view was that the number of species was fixed at the Creation. Evolutionary ideas, based on the *mutability of species* had been propounded from the time of Lucretius, as Darwin indeed acknowledged, but it was his capacity for theoretical induction from a mass of data which justly acclaims Darwin as "The Newton of Natural History".

Wallace having arrived independently at conclusions similar to those of Darwin, the two scientists jointly publicized the doctrine of evolution before the Linnaean Society on 1st July 1858. Thus it is appropriate that the centenary of this momentous advance in our understanding of the organic world should be marked by a book which reviews Darwin's work in the light of modern researches: for these have (via advances in genetics and palaeontology) vindicated his general conclusions, by dissipating former objections and by supplying new evidence.

The author deals with these matters, logically and lucidly, gradually cajoling the reader through the biological intricacies which convert hypothesis into fact. Since it was Malthus's *Essay on Population* which inspired Darwin with the idea that selective elimination of the "unfit" in the struggle for existence provided the mechanism for evolution, perhaps the ubiquity and subtlety of this phenomenon should have received fuller treatment.

It should not be forgotten that specialized living diminishes the potentiality to exploit new or changed environments. Dinosaurs lorded the earth for fifty million years, only to sink into oblivion. For mankind, the modern venue of the struggle for existence is largely on the psycho-social plane, and many detrimental influences are operating in society. Will modern man's intelligence enable him to avoid the social blunders which contributed to the fall of ancient civilizations? Are we really masters of our fate? In an era of apprehension, this attractively written book will be helpful to many in forming an educated opinion.

Pearson's Encyclopaedia of Chrysanthemums. MONICA BENNETT. Pearson. 21*s.*

There are books written by specialists which are worthy, unbelievably dull, and tedious. What a relief it is, therefore, to find a strain of bubbling enthusiasm running through Monica Bennett's comprehensive treatise on the chrysanthemum. Here is predominantly a book for the amateur, and there is no doubt that she has served him well. All the usual information about cultivation, pest and disease control and the rest is there, and the author has introduced some very helpful chapters on the controversial question of lifting incurved varieties, on obtaining successful exhibition blooms from them, and on growing chrysanthemums in small pots.

Most beginners find the question of when and how to stop the plants rather puzzling, but Miss Bennett deals with this problem clearly and succinctly. In her classified list of varieties she gives all the information necessary to enable growers either to let the plants form natural breaks, or stop them at the right moment to produce the required quantity of blooms. Her remarks about the use of vermiculite in chrysanthemum growing are apt and helpful, and she is unequivocal on the question of virus-infected plants—"destroy all affected plants immediately". This is sound advice; we must hope that all growers, commercial or amateur, will heed it, because there is no doubt that mosaic virus of chrysanthemums could easily become a major worry to us all.

R.H.

Statutory Smallholdings in Agriculture. E. A. ATTWOOD. Department of Agricultural Economics, University College of Wales. 7*s.* 6*d.*

It is just fifty years ago since a statutory duty was first placed on County Councils to provide smallholdings, and it is fitting that the golden jubilee year of 1958 should have been marked by the appearance of a penetrating study of smallholdings policy illustrated by an analysis of the position in Wales. We have come to expect publications by the Agricultural Economics Department of University College of Wales, Aberystwyth to be stimulating and thought-provoking; Mr. Attwood's latest work worthily maintains this reputation.

The author declares his aim to be to explain smallholdings policy and administration to the interested layman, but in the event he has achieved far more than this. For anyone who is concerned with the administration of smallholdings cannot fail to be grateful to him for bringing into focus many important and fundamental issues. After tracing the development of smallholdings policy—and a fascinating story it is—Mr. Attwood turns to what, as an economist, he would regard as the heart of the matter: the place of statutory smallholdings within the framework of agricultural policy and of the national economy generally. He is particularly concerned with the economic justification for smallholdings at a time when the problem of the small farm looms so large, and he concludes that only if the need of smallholdings as production units can be proved can an expansion in their number be justified. Mr. Attwood develops his arguments with many facts drawn from a study of smallholdings administration in Wales. The picture that emerges shows, perhaps not surprisingly, wide variations in the different counties. Equally wide variations are disclosed in an analysis of the results of a sample of selected Welsh smallholdings. The study concludes with a number of interesting suggestions for improving present policy and administration.

There can be no doubt that Mr. Attwood has performed a useful service in posing questions that are well worth asking, and in suggesting answers which give much food for thought.

P.P.

The Agricultural History Review (Vol. VI, Part II, 1958). Edited by H. P. R. FINBERG. The British Agricultural History Society. 12*s.* 6*d.*

The most substantial item in this issue is a review, by Shimon Applebaum, of the information now available on agriculture in Roman Britain. This makes a resolute attempt to reduce a medley of evidences and theories to a coherent story. The result is not wholly convincing; one paragraph, for example, supports the well-guarded hypothesis that "In some villas a degree of specialization may be supposed" by fourteen lines of argument containing one more "may", three "perhapses", three "suggestions", one "believed to be" and one "it is generally

thought". But text and footnotes illustrate very clearly the sheer mass of new knowledge which is now rapidly accumulating about even the more obscure periods and problems of our rural past. That is the main impression left by this journal. The implication is clear: constant revision is one of the primary duties of the agricultural historian.

It is significant, therefore, that the other two articles suggest amendments or additions to the findings of very recent research. In one, Dr. Simpson raises various questions on Dr. Allison's account of the peculiar East Anglian fold-course system. In the other, Alan Harris adds a local footnote to the general story of the deserted villages. And there is more, much, much more, to come. The section on work in progress lists some two hundred research projects now in hand. In 1953, in the first edition of this Review, the editor stressed the need for more detail in inquiries into agricultural history. A glance at the titles of these projects shows that his plea has been heard.

The journal ends with an agreeably international collection of reviews of books from Russia, Israel, France and the U.S.A. as well as from Britain.

N.H.

Grassland in England and Wales (with Special Reference to the Bristol II Province). (University of Bristol, Department of Economics Report No. 106.) V. H. BEYNON. 5*s*.

There has been a growing tendency for agricultural economists to produce and publish a wealth of tables and statistics, designed to prove that for maximum profitability in farming improved methods of production and utilization of the grass crop are essential. Probably with some justification, this mass of facts and figures has been regarded with a certain degree of scepticism, not only by practical farmers but also by other agriculturists who have prided themselves that good husbandry has always been their primary concern.

In the present circumstances, however, no one with any real interest in the future of farming in this country can afford to ignore the significance of carefully compiled economic data in helping to establish the basic principles of management. Farmers in the West of England, therefore, where over 75 per cent of the total farm acreage is grassland of one sort or another, should welcome this timely publication, which deals with Cornwall, Devon and Dorset. At the same time, agriculturists elsewhere should not be discouraged from reading it, for Mr. Beynon's report contains a wealth of information which should be of considerable interest and practical value to all who are seeking to maintain or increase profitability in farming.

Few will quarrel with the figures produced in this booklet, but not everyone will agree with all the conclusions which the author draws. This is not a bad fault, for it should surely be a prime duty of the author of any technical bulletin to stimulate the critical faculties of his readers, and in this Mr. Beynon has succeeded admirably.

It is perhaps unfortunate that insufficient emphasis has been given to the importance of high stocking rates in influencing efficiency of production per acre. The omission of a summary, in which the author's conclusions could be set forth briefly and concisely, is to be regretted. However, this is more than compensated for by the wealth of extremely useful technical information which is available at such a reasonable cost.

G.M.D.

Self-Feeding of Silage in Devon, 1957/58. (University of Bristol, Department of Economics Report No. 107.) V. H. BEYNON and J. A. LANGLEY. 2*s*. 6*d*.

Self-feeding of silage on thirty Devon farms, ranging from 30 to 450 acres (the majority below 200 acres), is reviewed in this report. Dairy cows only were fed on fifteen farms, dairy cows and young stock on nine, and stores on the others.

The types of silos and their costs, together with the crops ensiled and the methods of ensilage, are given. Yard-and-parlour systems of housing were practised on thirteen farms, providing 40 sq. feet per cow of lying area and a further 70 sq. feet for exercise. A half hundredweight of bedding straw per week was required. The various mixtures of foods fed with the silage, the length of time of access, and the width and control of the feeding face are discussed.

The authors also attempt to relate the performance expected by the farmers, the theoretical requirements of the stock, the assessed value of the ration and the actual

performance found. The latter was rather less than expected, probably because no allowance was made for the extra energy expended in self-feeding of kale and silage.

The figure for starch equivalent of 700-lb stores given in Table 20 as 2·08 lb should be 7·08 lb.

This is an interim report, pending continuation of the study. The authors, realizing the small number of farms involved and that observations cover one season only, draw no firm conclusions. They do, however, identify the factors likely to affect the success of self-feeding, and provide average figures of performance useful to others practising self-feeding or contemplating a change to this system.

J.R.G.

Norfolk Agricultural Station, Fiftieth Annual Report, 1957–58.

Half a century has passed since, in 1908, the Executive Committee of the Norfolk Agricultural Station issued its first report. The intervening years have seen many changes in Norfolk farming practice, not the least of which has been the coming of sugar beet to take the place of the older fodder roots. The Station at Sprowston has been associated with this change from the start, and farmers, many of them far removed from East Anglia, owe a debt to the Station and its director, Frank Rayns, for the demonstration and experimental work undertaken there.

According to this report, the average yield of sugar beet was 14¼ tons per acre (more than thirty per cent above the United Kingdom average). The current principal sugar beet project relates to the problem of reducing the spring demand for labour. One aspect of this work is the use, with good results, of small grade rubbed seed ($\frac{7}{64}$–$\frac{9}{64}$ths-inch, instead of the standard $\frac{7}{64}$–$\frac{1}{2}\frac{1}{4}$ths-inch). Others include tests of seed dressings, chemical control of weeds, precision drilling, and mechanical thinning.

The sowing of sugar beet at low seed rates by use of a precision drill is the subject of special comment. The trials began in 1954, and a wide range of spacing was tested to determine the point at which the saving in hand work was offset by the increased risk of plant populations below the ideal. It is concluded that provided related operations are carried out with care and under good conditions, savings in singling time of up to 17 per cent can be obtained without loss of yield.

One of the most striking features of Sprowston—it might even be described as unique—is the fact that, despite the magnitude and variety of the experimental work undertaken, the Station is run on a commercial basis to such good effect that the farm account for 1957–58 shows a surplus of well over £9,000.

P.R.

Averages of Rainfall for Great Britain and Northern Ireland, 1916–1950. H.M. Stationery Office. 4*s.* 6*d.* (4*s.* 10*d.* by post).

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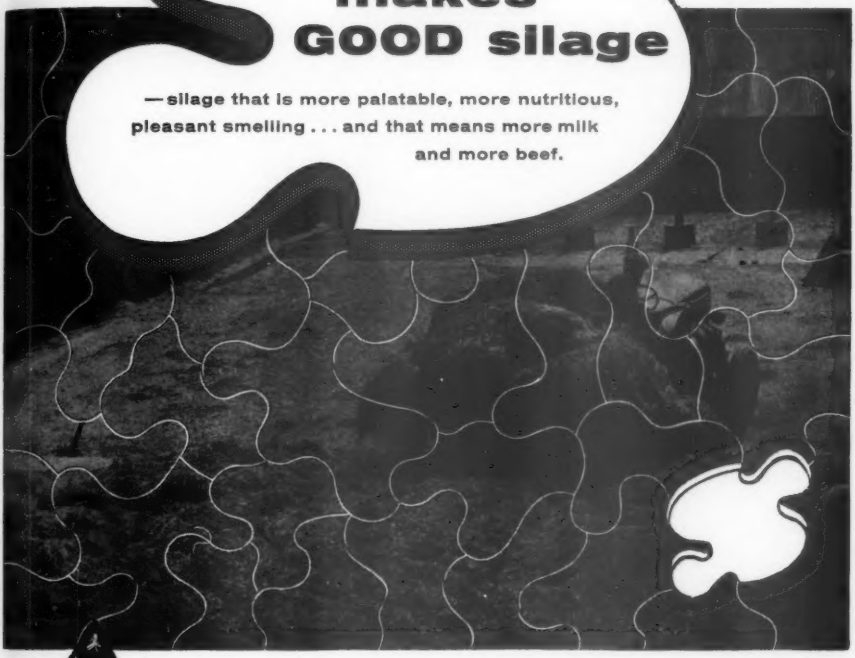

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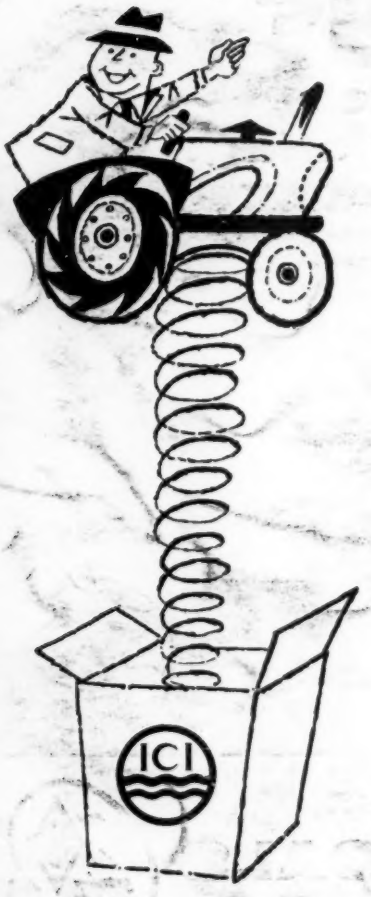

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